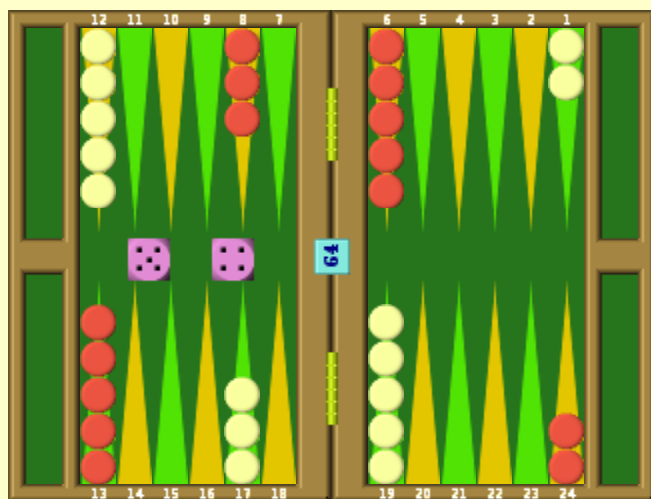


GNU Backgammon (RED) versus Human Opponent (WHITE)

Single Game--played October 6, 2014

Note: The diagrams in this annotated game were computer-generated by the GNU Backgammon neural net Backgammon program. The program reverses the labeling of the numbers of each point with each diagram. Each commentary section refers to the numbers of the points for the diagram within that commentary section. This game was played and annotated by John Mamoun, the human opponent. Public Domain material. No copyright. Info on how this PDF file was made is at the end of the PDF file.

Move number 1: GNU Backgammon to play 54



Pip counts: GNU Backgammon 167, opponent 167

• **GNU Backgammon moves 24/20 13/8**

#	Ply	Move	Equity
• 1	3	24/20 13/8 0.507 0.136 0.007 - 0.493 0.128 0.005	+0.034
2	3	13/9 13/8 0.499 0.153 0.008 - 0.501 0.138 0.007	+0.018 (-0.016)
3	3	24/15 0.504 0.121 0.005 - 0.496 0.133 0.005	+0.003 (-0.031)

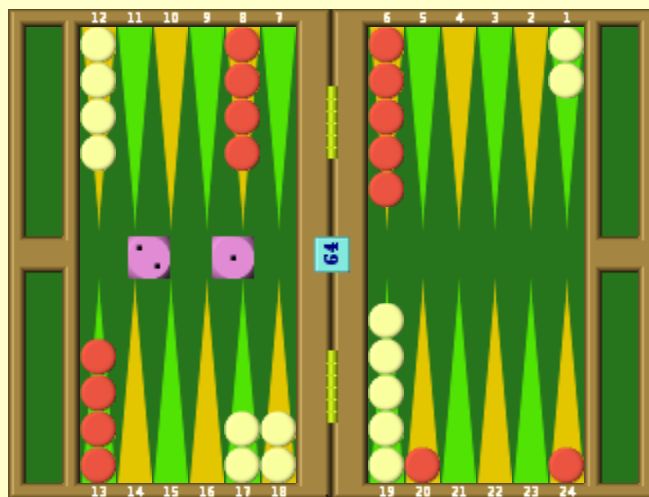
Commentary: In the initial moves of a Backgammon game, either opponent wants to make blocking points. The center of Backgammon strategy is placing blocking points in the opponent's way as obstacles to slow down the opponent's ability to race to the bear-off quadrant. A player especially wants to put blocking points in the player's bear-off quadrant, so that if the player hits an opponent's blot, the opponent will lose time getting back into that quadrant due to the blocks. In this diagram, GNUBG's (RED) bear-off quadrant consists of the 6 to 1 points, while the opponent's (WHITE) bear-off quadrant consists of the 19 to 24 points. In Backgammon theory, in general, by convention, the blocks inside a bear-off quadrant are referred to as the 6, 5, 4, 3, 2 or 1 point blocks. The most valuable blocking points are the 6 point (which is given in the initial Backgammon game setup), then the 5 point, then the 7 point, then the 4, 3, 2 and 1 points. Generally, inner board blocking points are more valuable the farther away they are from the 1 point. The 6, 5 and 7 points are key points in preventing the escape of a back checker during the game. A noted Backgammon expert said that the 5 point is so important that a player should "beg, borrow or steal, but make that five point." The earlier on in the game that the 5 point block is made, the more valuable the block is, because with each move it exists as an obstacle or potential obstacle to the opponent, restricting the opponent's movements and reducing the opponent's ability to make risky decisions, particularly when leaving a blot to make a higher risk, higher yield move, since the costs of getting a blot hit are higher if the opponent has made the 7, 5, 4 and 3 points, in particular.

Here, GNU Backgammon has rolled a 5-4, which does not allow GNU Backgammon to make a blocking point. Instead, GNU Backgammon brings down a spare builder to the 8 point, and splits the back checkers to place a blot and builder on the opponent's projected 5 point block. If GNUB's blot is hit, the cost is minimal, since the blot is close to the beginning of GNUB's board, with minimal PIP loss if it is hit, and opponent's inner board is still wide open, making it relatively easy for GNUB to return. Meanwhile, any four rolled will allow GNUB to cover the blot, creating a key defensive point and blocking the opponent's ability to form the opponent's own five point.

13/9, 13/8 is not as good because of the risk of having the blot on 9 hit, with considerable loss of PIPs. There is also a substantial risk of not being able to cover or secure the blot on the next move. Although, having an extra builder on 9 increases the probability of being able to form an inner board point on the next move. Not a bad move, but "close but no cigar" compared to 24/20, 13/8.

- opponent moves 13/7 8/7

Move number 3: GNU Backgammon to play 21



- **GNU Backgammon moves 24/21**

Cube decision

3-ply cubeless equity +0.071

0.523 0.139 0.006 - 0.477 0.117 0.004

Cubeful equities:

1. No double	+0.090	
2. Double, pass	+1.000	+0.910
3. Double, take	-0.184	-0.274
Proper cube action: No double, beaver (23.2%)		

#	Ply	Move	Equity
• 1	3	24/21 0.467 0.113 0.006 - 0.533 0.159 0.006	-0.150
2	3	24/23 13/11 0.463 0.125 0.007 - 0.537 0.161 0.007	-0.156 (-0.006)
3	3	13/11 6/5 0.463 0.126 0.006 - 0.537 0.173 0.010	-0.174 (-0.025)

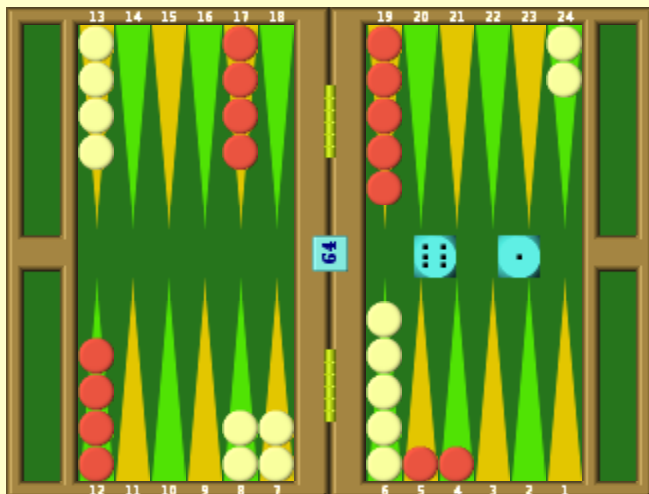
Commentary: GNUBG performed a cube decision analysis and decided that it was too early to double, and that doubling the stakes would harm GNUBG given GNUBG's weaker position against a 3-point prime. Note some basics of doubling analysis here. If GNUBG doubled and the opponent passed, GNUBG would be guaranteed 1 point. Of course, the opponent would accept the double and not pass, given the opponent's better position. But if the opponent took the double, GNUBG would lose equity compared to not doubling, given that it is not rational to double the stakes when one's position is weaker than the opponent. Not doubling is relatively superior to doubling. As for the opponent on the next move, the opponent could double, but it is often premature to double this early in the game.

GNUBG concludes that its best move is the relatively wimpy 24/21. This may be due to GNUBG's fears that leaving a blot is dangerous due to the high cost of having a blot sent back behind a 3-point prime. If the opponent's 7 point was not occupied, GNUBG would have much less risk and cost of having a blot hit, and would likely have chosen 24/23 13/11 or 13/11 6/5, both of which bring down blots that can potentially be used to form points in GNUBG's goal quadrant. There is a very small advantage of 24/21 over 24/23 13/11 in GNUBG's analysis. Playing safe, according to GNUBG, is more advantageous than risking a blot on 13/11, despite all of the advantages of that blot. Some professional human opponents would play 24/23 13/11 in the real world, since the game is early enough in its stages to recover the loss if the blot is hit. Although, if the blot is hit, GNUBG would be vulnerable to a double by the opponent. 13/11 is generally superior to 6/5 since there are far fewer chances of the opponent hitting the blot on 11 versus on the 5. A combination dice value of 10 would be required to hit the blot on 11, whereas any 4, plus other combinations, would allow a hit on the 5. Of course, if GNUBG

left a blot on 5 and got away with it next move, GNUBG would be at a considerable advantage, since any 1 or 3 would allow GNUBG to cover that blot, securing the coveted 5 point block.

Players should keep in mind the basic fact that the chance of hitting any one single number is 1/6 per dice, and slightly more than 2/6 given two dice are thrown. This is much less than hitting a number greater than 7 using a combination of dice.

Move number 4: opponent to play 61



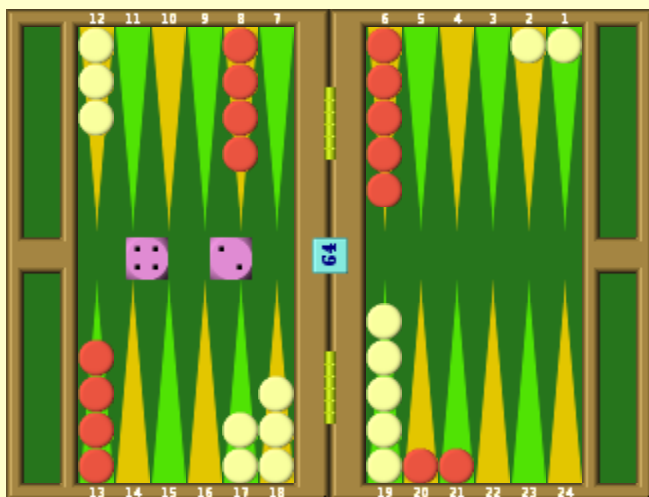
Pip counts: GNU Backgammon 155, opponent 160

• opponent moves 24/23 13/7

Commentary: 13/7 brings a builder down to the 7 point. 24/23 splits the back checkers and increases the danger to GNUBG of being hit if GNUBG leaves a blot on the inner board in hopes of covering it later to form a point. 13/7 6/5 is a high-risk, high yield move where the opponent simultaneously hits the GNUBG blot on the 5 point and also slots on the 5 point. This gives GNUBG multiple return shots, including any 5 or any 1, except for a 1 contained in a 6-1 roll, to hit the opponent's blot on the 5 point. Although, if GNUBG does not hit the blot, the opponent will have two builder blots to make the 5 point. Some aggressive players will play this move, but there are generally too many return shots. 13/6 is merely a racing move that does nothing to help create blocking points or to help prevent GNUBG from creating blocking points. A basic principle of Backgammon is that, in general, simple racing moves are of minimal or no advantage in the opening game, and are generally a disadvantage because the opportunity cost of using a move to simply race checkers is that the move cannot be used to create or help create blocking points. Generally, in the opening game, pure racing moves are only done if there is no better option. For example, rolling a 6/5 as a first roll generally forces a racing move of 24/13 because generally there is no better move mathematically, although some players might play 24/18, 13/8, but doing so risks "going under the gun." This means that the blot on the 18 could be hit and used to keep the opponent off balance or to cost the opponent a tempo while using the

opportunities caused by that to build up blocking points.

Move number 5: GNU Backgammon to play 42



Pip counts: GNU Backgammon 155, opponent 153

- GNU Backgammon moves 8/4 6/4

Cube decision

3-ply cubeless equity +0.039

0.521 0.121 0.004 - 0.479 0.124 0.003

Cubeful equities:

1. No double +0.053
2. Double, pass +1.000 +0.947
3. Double, take -0.253 -0.307

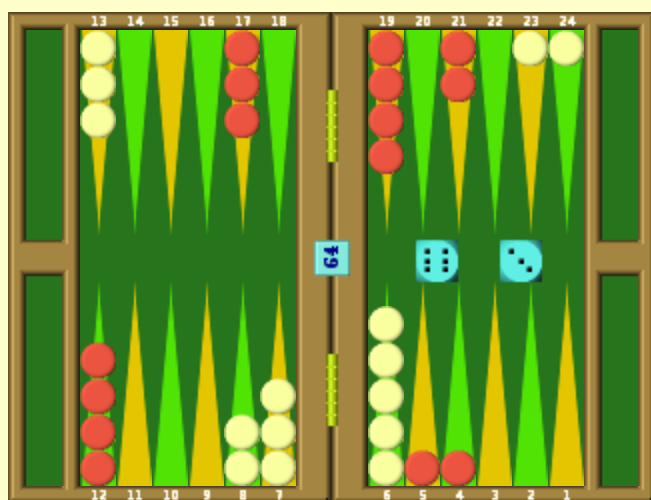
Proper cube action: **No double, beaver (24.5%)**

#	Ply	Move	Equity
• 1	2	8/4 6/4 0.510 0.138 0.006 - 0.490 0.142 0.004	+0.016
2	2	20/14 0.465 0.101 0.003 - 0.535 0.169 0.005	-0.178 (-0.194)
3	2	20/16 13/11 0.458 0.107 0.004 - 0.542 0.180 0.008	-0.211 (-0.227)

Commentary: Rolling a 4-2 is always useful in the opening game, since it allows immediate creation of the 4 point block, a block that is almost as valuable as the 5 point block due to it being closer towards the outfield of the bear-off board. In the

opening game, using a 4-2 roll to make the 4 point is almost an automatic move, and rarely in the opening game are there more compelling options. 20/14 is a pure running move, which is generally not useful in the opening game. There is also a high cost if the blot on 14 is hit, given that there is a 3-point prime in place. Also, opponent would have various opportunities to hit blots and cost GNUBG some tempos, or if lucky to make a point on 21 while hitting GNUBG's blot on 21, all the while leaving the blot on 14 exposed to be hit the next move. 20/16 13/11 is a combination racing move and a move that brings a builder into position. However, this move leaves too many blots exposed. If the opponent hits just one of these blots, opponent can potentially keep hitting blots and forming points until a 6-point prime was created, or can cost GNUBG so many tempos that GNUBG becomes far behind in the race.

Move number 6: opponent to play 63



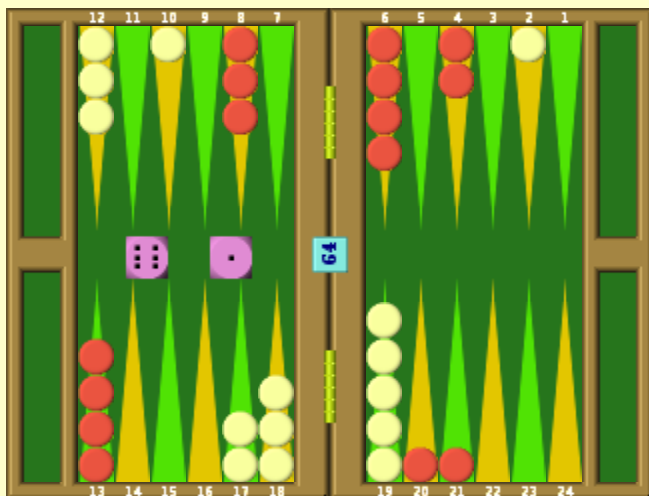
Pip counts: GNU Backgammon 149, opponent 153

- opponent moves 24/15

Commentary: Not a particularly useful roll. One option was 13/7 7/4 to hit the blot on 4 and put a blot on 4 to try to close it on the next move and form a point. This is not necessarily a bad move, although it is risky if GNUBG hits the blot on the next move, which would result in opponent having a total of 3 blots in GNUBG's bearoff quadrant, in which GNUBG has 2 points already in place. 13/7 7/4 also strips the 13 point of its spare builder, which reduces opponent's mobility in general, if the opponent has a chance to hit a blot left by GNUBG using a checker originating from the 13 point. 13/7 6/3 is a safe move that puts a blot on the 3 point, which is a compelling move and perhaps the most correct move, although if opponent cannot cover the 3 point as soon as possible, the blot on 3 will increase the cost of opponent hitting any blot left behind by GNUBG, since GNUBG obviously can hit the blot on the 3 point during the return move. Opponent chose a simple running move of 24/15, which risks some loss of PIPS from the blot being hit, although has the advantage of extricating a back checker from a quadrant that is becoming more and more "noose-tightened" from the

17, 19 and 21 points that have so far accumulated there.

Move number 7: GNU Backgammon to play 61



Pip counts: GNU Backgammon 149, opponent 144

• GNU Backgammon moves 21/20 8/2*

Cube decision

3-ply cubeless equity +0.233

0.580 0.159 0.004 - 0.420 0.087 0.003

Cubeful equities:

1. No double +0.326
2. Double, pass +1.000 +0.674
3. Double, take +0.179 -0.147

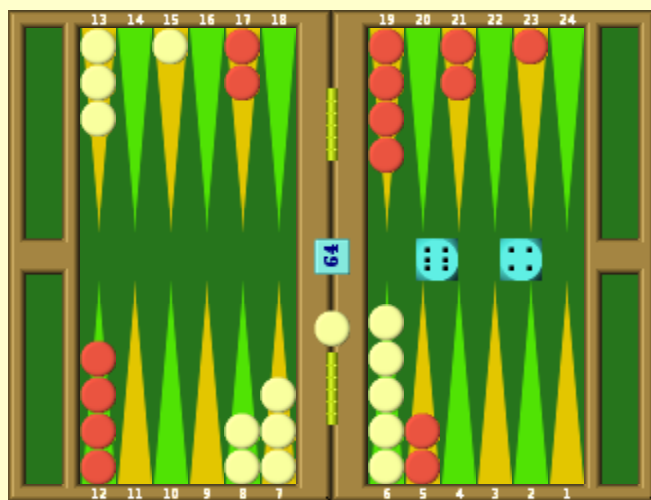
Proper cube action: **No double, take (17.9%)**

#	Ply	Move	Equity
• 1	3	21/20 8/2*	+0.208
		0.532 0.165 0.004 - 0.468 0.078 0.002	
2	3	21/20 13/7	+0.169 (-0.039)
		0.527 0.150 0.003 - 0.473 0.071 0.001	
3	3	13/7 8/7	+0.119 (-0.089)
		0.531 0.145 0.005 - 0.469 0.124 0.004	

Commentary: Interesting roll and GNUBG analysis. It would seem automatic to use the 6-1 roll to form the 7 point, which lays the foundation for a 5 or 6 point prime and threatens to seal in the blot on 2. But, due to other compelling priorities, GNUBG decided that two other move options were superior to this

"automatic" move. GNUBG thinks that covering the 20 point is more important than making the 7 point. Forming a block on the 20 point prevents the opponent from forming a point here. The 20 point defensive block is an outfield defensive block that greatly improves GNUBG's ability to defend against opponent's 3-point prime on 17, 18 and 19. Having this anchor improves GNUBG's mobility, allowing it to take increased risks by leaving blot builders on the board. These blots if hit can always potentially land on the outfield 20 point and be poised to escape. After closing the 20 point, GNUBG now decides what to do with the 6 dice number. GNUBG has a choice between 13/7 or 8/2*. Leaving these blots would be dangerous if GNUBG did not close the 20 point, but by closing it, GNUBG can now afford to take these risks. GNUBG decided that hitting the blot on 2 was superior to placing a builder on 7. The point on 7 is probably more valuable than the point on 2, which is deep into the bear-off board and generally less valuable than an outfield block in the bear-off quadrant. However, fewer combinations of rolls allow the opponent to hit the blot on 2 versus hitting the blot on 7. Also, a combination move of hitting a blot while simultaneously creating a blot builder tends to be a powerful move in Backgammon, since the risk of leaving the blot is offset by the loss of tempo that is inflicted on the opponent by hitting the opponent's block, and is also offset by the potential powerful advantages that occur if the opponent cannot re-enter on the opponent's next move.

Move number 8: opponent to play 64



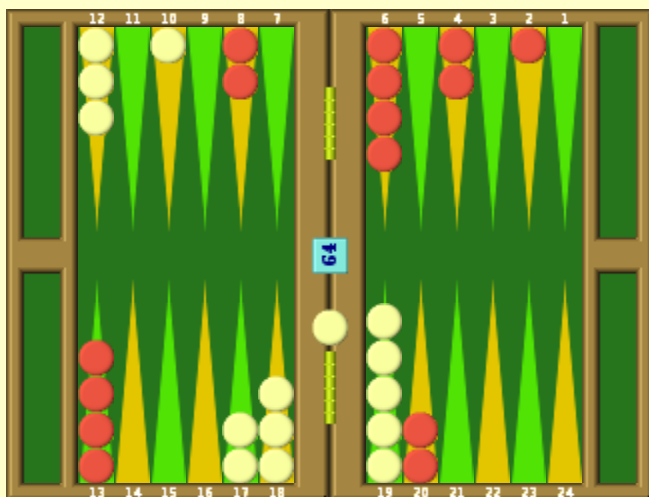
Pip counts: GNU Backgammon 142, opponent 146

- opponent cannot move

Commentary: The opponent not being able to come in has substantially improved GNUBG's prospects. At this juncture, GNUBG can potentially cover the blot on 23, and bring down builder blots on 18 to start closing the 18 point, while potentially hitting opponent's blot on 15, resulting in two of opponent's blots being on the bar, causing opponent great loss of tempo that GNUBG can exploit, to eventually create a 4-6 point long prime to block out those blots. GNUBG may be tempted to double at this juncture, although the double may be a bit premature given the

game is still somewhat in the earlier stages with an open board structure in which various lucky rolls can swing the game in either player's advantage.

Move number 9: GNU Backgammon on roll, cube decision?



Pip counts: GNU Backgammon 142, opponent 146

Cube decision

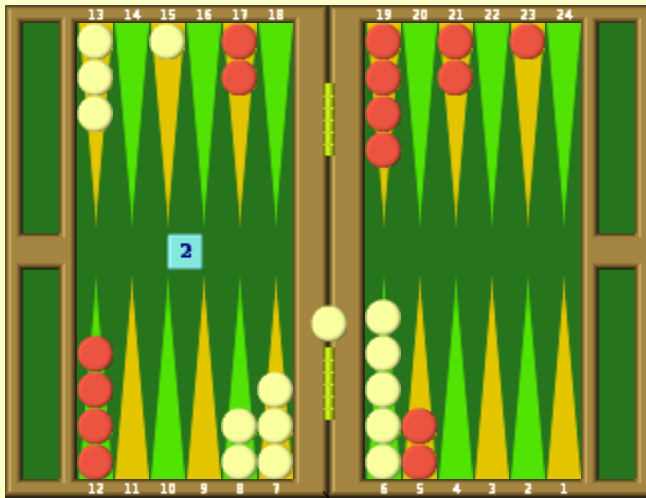
2-ply cubeless equity +0.492
0.638 0.273 0.007 - 0.362 0.061 0.001

Cubeful equities:

1. Double, take +0.739
2. Double, pass +1.000 +0.261
3. No double +0.655 -0.084

Proper cube action: **Double, take**

Move number 10: GNU Backgammon doubles to 2

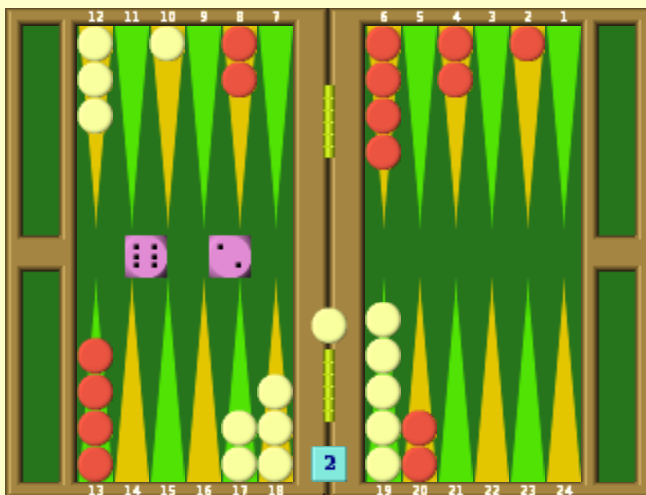


Pip counts: GNU Backgammon 142, opponent 146

- opponent accepts

Commentary: Doubling has a mathematical advantage for GNUBG, while passing the double is more costly for the opponent than taking the double. The game is a bit too premature for opponent to not take the double, with some real possibilities of opponent gaining a clear advantage, despite the theoretical threat of GNUBG possibly trapping two of the opponent's blots with 4-6 point primes. The opponent's ownership of the cube also gives an added advantage to taking the double.

Move number 11: GNU Backgammon to play 62



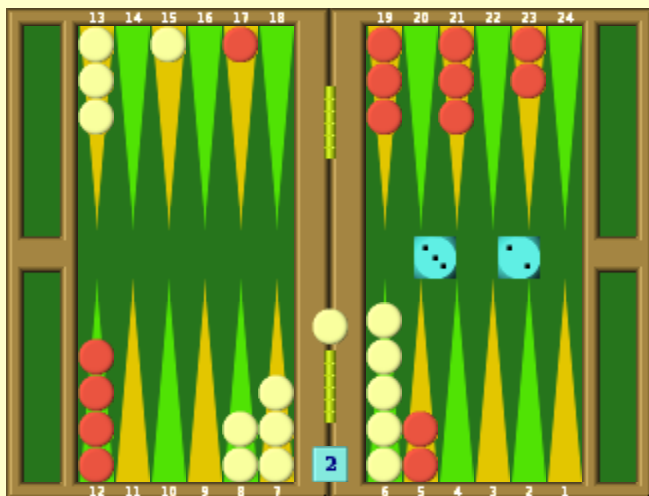
Pip counts: GNU Backgammon 142, opponent 146

• GNU Backgammon moves 8/2 6/4

#	Ply	Move	Equity
• 1	3	8/2 6/4 0.620 0.257 0.006 - 0.380 0.060 0.002	+0.311
2	3	13/11 8/2 0.610 0.265 0.006 - 0.390 0.064 0.002	+0.291 (-0.020)
3	3	8/6 8/2 0.608 0.232 0.005 - 0.392 0.061 0.001	+0.258 (-0.053)

Commentary: GNUBG uses the 6 to cover the blot on 2, and now decides what to do with the 2 dice number. 6/4 is a safe move that also puts a spare builder on the 4 point, and provides the tiny (but in rare instances critical) advantage of creating a more even distribution of checkers in preparation for the later bear-off phase of the game. The spare builders increase GNUBG's chance of forming blocks on the 5 and 3 points during the game. It would be costly if the blot on 8 was hit, however, hitting the 8 blot would require an indirect shot by the opponent that is probabilistically unlikely. Meanwhile, any 4 on the next move would allow GNUBG to cover the 8 blot and reconstruct the valuable 8 point block. 13/11 8/2 is a close second place to 8/2 6/4, but 13/11 8/2 leaves two blots on the 11 and 8 points. It would be costly if either of these blots were hit and sent back behind the opponent's 3-point prime. Generally it is too risky to leave two blots exposed in Backgammon, particularly if the hitting of either blot is substantially costly. However, 13/11 8/2 has increased value despite its risk because GNUBG will be at a huge advantage if the opponent cannot come in on the next move. The hugeness of the advantage of that possibility uplifts the value of the move. The super-safe running move of 8/6 8/2 is a disadvantage because it eliminates the point on 8 and eliminates the builder blot that would remain on 8 with the other move choices. Losing the 8 point, or losing the possibility of re-forming the 8 point on the next move by closing the blot on the 8 point, are both huge disadvantages that greatly reduce the value of playing this super-safe move. Too much risk hedging can be more costly in the long run compared to doing more risky decisions in a given situation! This simple, classic idea must always be kept in mind when investing, and also when playing Backgammon.

Move number 12: opponent to play 32

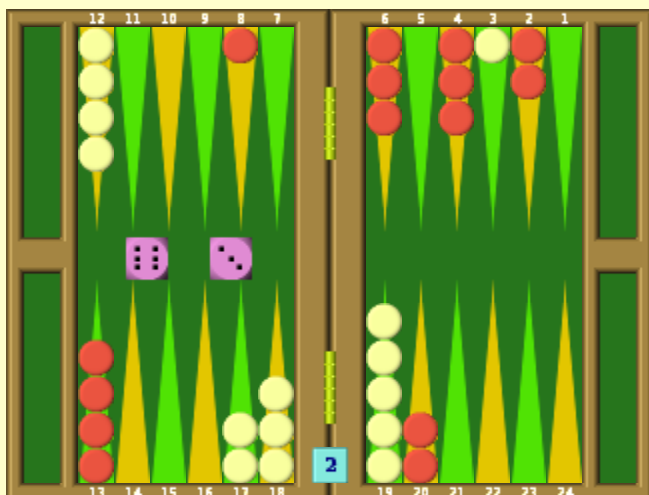


Pip counts: GNU Backgammon 134, opponent 146

• opponent moves bar/22 15/13

Commentary: The 3 is forced. For the 2, the reasonable options are 15/13 or 6/4. Due to the dangers of leaving the #15 blot exposed given GNUBG's 3 points on GNUBG's bear-off quadrant, with points on 19, 21 and 23, it is better to play it safe and secure the blot on 15 by moving it to 13, which also adds a builder on 13. Placing a blot on 4 might be nice since there is a high chance of covering the blot next move, and this helps to distribute checkers from the 6 point, but the advantages do not outweigh the dangers of leaving the blot on 15, particularly since GNUBG's builder blot on 17 can be covered, creating 4 blocks in the vicinity of GNUBG's bear-off quadrant. This would also help to pave the pathway for creating a formidable prime structure in that quadrant, although GNUBG would be a bit delayed in doing so due to lack of builders for creating key points on the 18 and 20 spaces.

Move number 13: GNU Backgammon to play 63



Pip counts: GNU Backgammon 134, opponent 141

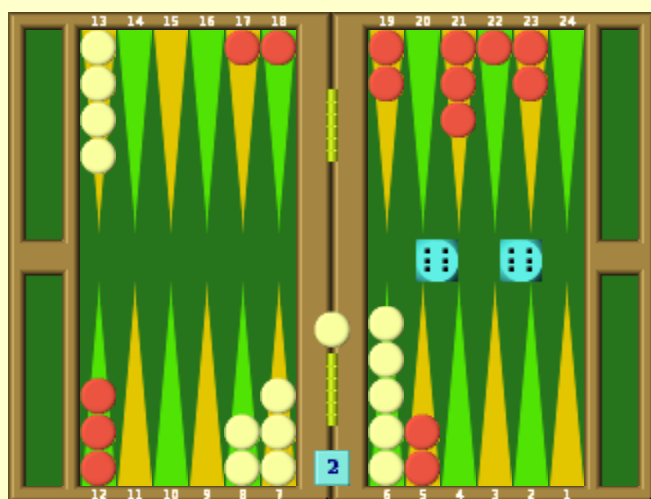
• GNU Backgammon moves 13/7 6/3*

#	Ply	Move	Equity
• 1	2	13/7 6/3*	+0.077
		0.554 0.198 0.003 - 0.446 0.077 0.003	
2	2	8/2 4/1	-0.040 (-0.117)
		0.529 0.138 0.001 - 0.471 0.075 0.002	
3	2	13/10 8/2	-0.042 (-0.119)
		0.528 0.128 0.002 - 0.472 0.066 0.002	

Commentary: GNUBG's evaluation of the options for this 6-3 die throw is interesting and counter-intuitive. 20/11 is a risky running move that prematurely breaks the 20 defensive point and exposes GNUBG to going "under the gun" by having the opponent hit the blot on 20 and make inner points systematically. 13/10 8/2 is the safest move, putting a 13 on the 10 point, which is 7 PIPS away from the opponent's checker on 3, putting GNUBG's blot just out of range of a direct 6 shot. This illustrates a general idea in Backgammon, that if you have to leave a blot, there is a big increase in safety when putting the blot just beyond a direct shot, versus leaving it in range of a direct shot that requires only a single number from a dice to hit the blot. The blot on 10 would be much safer than if the blot was put on 9. However, here, GNUBG thinks that playing it safe is not useful. Opponent's checker on the 3 point can escape due to the wide open quadrant from 7-12. That escape would quickly turn the game into a running game, and when GNUBG finally broke the 20 defensive point, there would be many opponent

checkers in range to hit the blot on the 20 point. This could potentially close out GNUBG, and opponent controls the doubling cube. Opponent can also hit the blot on the 10 point, leading to further complications. GNUBG thinks that 8/2 4/1 is a better option than 13/10, 8/2. This move combines safety, by moving the 8 blot to the 2 point, with an offensive move designed to help prevent escape of opponent's back checker, by using the combination blot-hitting and builder blot positioning move of 4/1. A drawback with 8/2 4/1 is that it is difficult to cover the blot on 3 on the next turn, assuming that opponent does not hit the blot on 3 when returning from the bar. Only the 6 point has a spare builder to cover the blot on 3, and there is a low probability of rolling a 10 to cover the blot on 3 using a checker from the 13 point. GNUBG's blot on 3 may be exposed not just for the next move, but maybe the next two moves. GNUBG then decides that 13/7 6/3* (a very dangerous move!), is the best overall option. This high risk, high return move aggressively hits opponent's blot on 3, and exposes three of GNUBG's blots overall, while having blots on 8 and 7 in position to cover the blot on 3 in the next move with a high probability. The opponent's bear-off quadrant is open and also has GNUBG's defensive 20 point anchor, greatly reducing GNUBG's cost of being hit. Meanwhile, if the opponent does not return on the next roll, or does not hit the blot on 3, GNUBG will be in a greatly improved position at the next roll, with numerous chances of creating points on GNUBG's bear-off board, and much better chances of blocking the escape of opponent's back checker. GNUBG thinks that the game has reached a critical point where escape of the opponent's back checker can result in a running game, with no clear advantage for GNUBG in this running game. This is an example of a "pay now, pay later" move. With an open opportunity for the opponent to escape the back checker, GNUBG must take a radical risk now, while the opponent's bear-off board is relatively open, to kick the opponent's back checker into a position of entrapment.

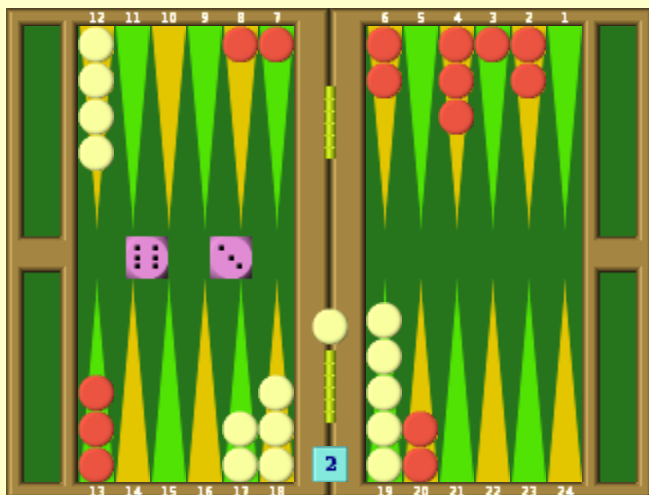
Move number 14: opponent to play 66



Pip counts: GNU Backgammon 125, opponent 144

- opponent cannot move

Move number 15: GNU Backgammon to play 63



Pip counts: GNU Backgammon 125, opponent 144

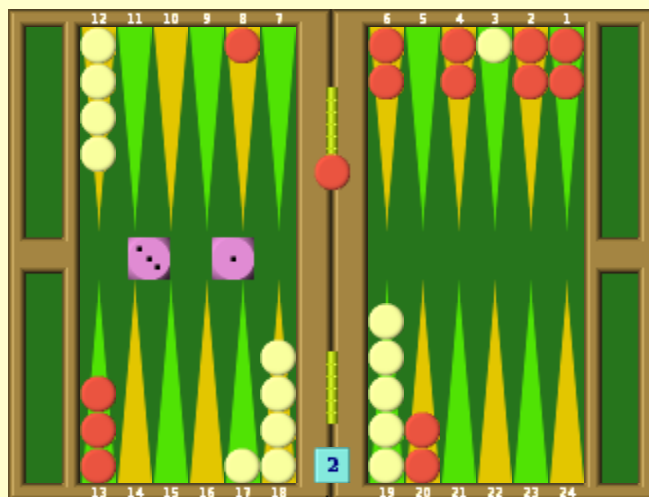
• GNU Backgammon moves 7/1 4/1

#	Ply	Move	Equity
• 1	2	7/1 4/1 0.632 0.311 0.003 - 0.368 0.069 0.003	+0.381
2	2	13/10 13/7 0.594 0.255 0.004 - 0.406 0.074 0.003	+0.228 (-0.153)
3	2	13/7 8/5 0.567 0.227 0.004 - 0.433 0.069 0.002	+0.144 (-0.237)

Commentary: 13/7 8/5 leaves too many blots in GNUBG's bearoff quadrant. 13/10 13/7 forms the point on the 7, but prematurely breaks the point on 13, leaving a blot on 13 and breaking a critical safety anchor for eventually allowing the checkers on the 20 point to be moved to safety when GNUBG eventually has to break the 20 point. 7/1 4/1 is not ideal since it forms the deepest block on the 1 point in the bearoff quadrant. However, This safe play helps to consolidate the position somewhat by removing the blot on 7 and further hindering the opponent's ability to come in by creating another point in the bearoff quadrant. The blot on 3 remains, however, as does the blot on 8. Leaving the blot on 3 beyond the next move was one of the calculated risks associated with the high risk, high yield 6-3 play that GNUBG made in move number 13 previously.

- opponent moves bar/22* 8/7

Move number 17: GNU Backgammon to play 31



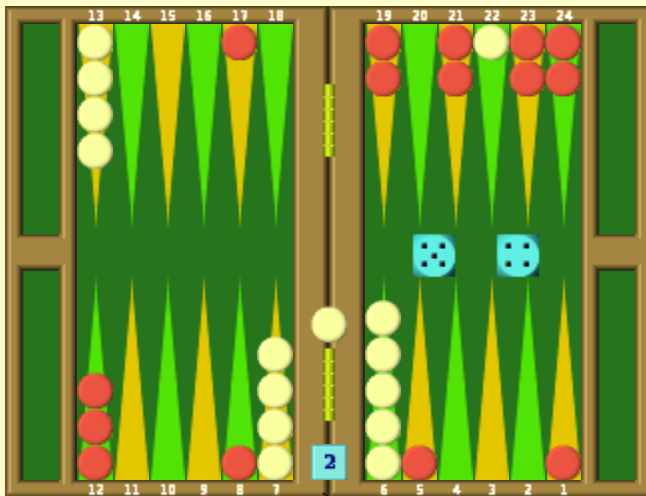
Pip counts: GNU Backgammon 138, opponent 140

- GNU Backgammon moves bar/24 20/17*

#	Ply	Move	Equity
• 1	0	bar/24 20/17*	+0.370
		0.630 0.317 0.007 - 0.370 0.086 0.003	
2	0	bar/22 8/7	-0.090 (-0.459)
		0.502 0.164 0.003 - 0.498 0.089 0.002	
3	0	bar/24 8/5	-0.099 (-0.469)
		0.497 0.183 0.003 - 0.503 0.104 0.003	

Commentary: bar/24, 20/17* is obviously the best move here. Moving 8/7 reduces the shots that opponent has to hit the blot compared to leaving the blot on 8, but this advantage pales in comparison to hitting the blot on 17. The opponent now pays for the blunder from the previous move.

Move number 18: opponent to play 54

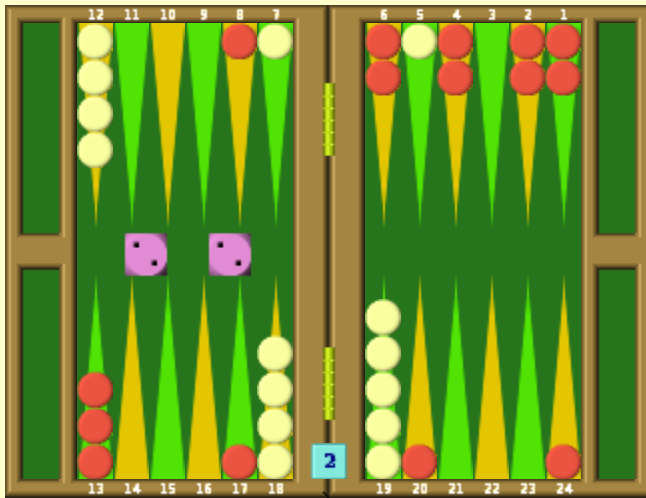


Pip counts: GNU Backgammon 134, opponent 157

- opponent moves bar/20 22/18

Commentary: The 5 is forced. How to play the 4? 22/18 was chosen because it allows the builder blot on the 20 point to remain, providing a chance of forming a defensive 5 point later on, if the blot on 18 is hit. 20/16 would be better in that there are approximately half as many chances of hitting the blot on 16 compared to leaving the blot on 18. A rollout could tell which move was better. Neither option is too good here, of course. This possibility of this awkward die roll and move was another result of the blunder from two moves back.

Move number 19: GNU Backgammon to play 22



Pip counts: GNU Backgammon 134, opponent 148

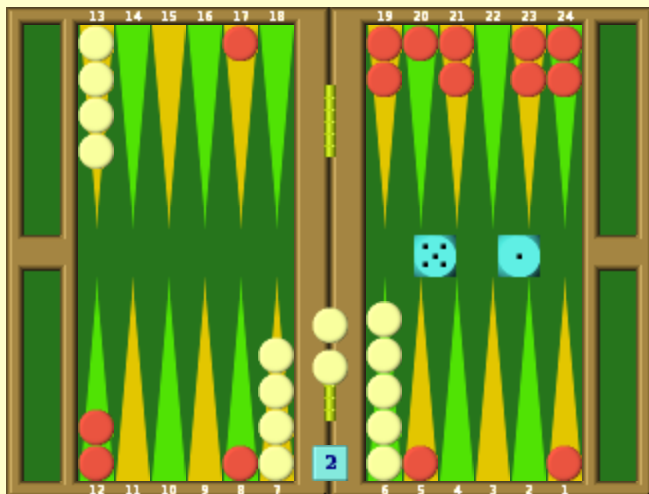
• GNU Backgammon moves 13/7*/5*

#	Ply	Move	Equity
• 1	0	13/7*/5*	+0.846
		0.737 0.516 0.011 - 0.263 0.063 0.003	
2	0	13/7* 8/6	+0.508 (-0.339)
		0.661 0.379 0.006 - 0.339 0.080 0.003	
3	0	24/22 13/7*	+0.465 (-0.381)
		0.654 0.361 0.006 - 0.346 0.087 0.004	

Commentary: With the opponent's bear-off quadrant wide open and only blocking points on 18 and 19 present in the area, GNUBG faces little danger in making high risk/high return moves where it leaves blots. GNUBG then chooses the powerful move of 13/7*/5*, which also leaves GNUBG's blot builder on the 5 point. Hitting two blots while leaving a builder on one's bear-off quadrant is often a powerful move in Backgammon. With four blocks in GNUBG's bear-off quadrant, the opponent's mobility will be restricted unless both blots are moved back in, which is unlikely to happen on the next move. Even if the opponent gets one blot in, GNUBG can keep hitting that blot until GNUBG closes out the bear-off quadrant. If the opponent does not roll a 5, GNUBG has a good chance of closing the 5 point blot. 13/7* 8/6 combines offense with safety, but this roll gives the opponent some ability to recover a tempo because the opponent would have only one blot out, and has some ability to hit GNUBG's blot on the 7 point. GNUBG does not have to be this safe when the opponent's bearoff board is wide open, and there is a higher expected return from playing the bigger offensive move of hitting the two blots. 24/22 13/7* leaves two blots on the 8 and 7 points, giving the opponent move opportunities for possibly hitting a blot and recovering a tempo compared to

moving the 8 blot to safety. Again, a strong offensive play yields higher returns. GNUBG is applying the old, pitiless, brutal Backgammon axiom, that "once your opponent is down, kick him down hard."

Move number 20: opponent to play 51

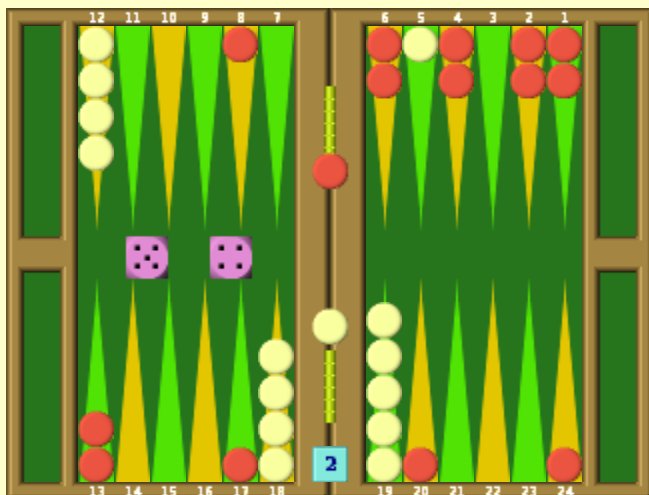


Pip counts: GNU Backgammon 126, opponent 160

- opponent moves bar/20*

Commentary: Forced move. The opponent kicked out GNUBG's 20 point builder, but it is still an open question if it is possible to recover from this tough situation.

Move number 21: GNU Backgammon to play 54



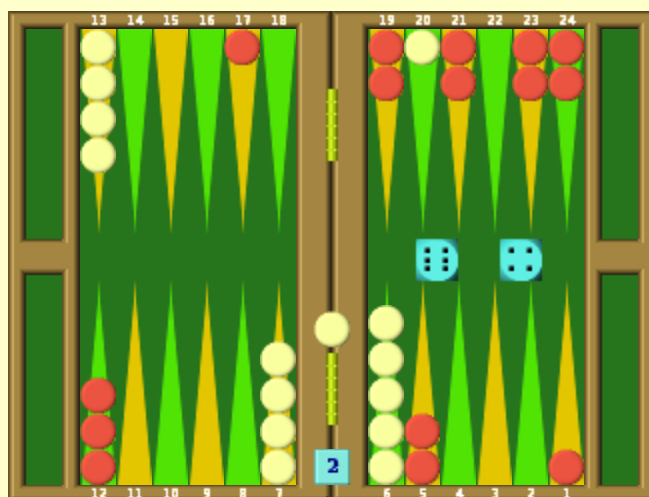
Pip counts: GNU Backgammon 146, opponent 155

- GNU Backgammon moves bar/20 17/13

#	Ply	Move	Equity
• 1	3	bar/20 17/13 0.624 0.288 0.004 - 0.376 0.076 0.003	+0.333
2	3	bar/20 13/9 0.606 0.322 0.005 - 0.394 0.098 0.005	+0.301 (-0.032)
3	3	bar/20 24/20 0.614 0.269 0.004 - 0.386 0.074 0.003	+0.294 (-0.040)

Commentary: The best way to play the 5 is to complete the 20 point anchor. Bar/21 13/8 is a possibility, but generally in Backgammon it is risky to break a 13 point anchor except for a really good reason. Making the 8 point can be useful as an advanced anchor, but the 8 point anchor is not especially necessary or required at this junction, given that the opponent's bear-off board is still wide open, and that it is not very costly for GNUBG for the opponent to hit one of GNUBG's blots due to the opponent's wide open bear-off quadrant. GNUBG uses the 4 to consolidate its position by moving the blot on 17 to safety, which also confers the advantage (which often comes in handy at critical moments in Backgammon) of having a spare builder on the 13 point anchor to use for forming points or hitting blots. 24/20 is a nice move for moving the 24 checker into position for it to be run away, but given the wide open bear-off quadrant, it is not urgent at this time to run the checker on the 24 point.

Move number 22: opponent to play 64

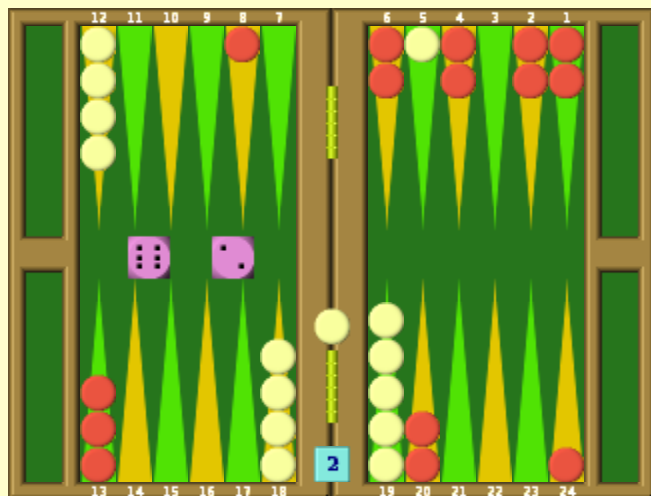


Pip counts: GNU Backgammon 137, opponent 155

• opponent cannot move

Commentary: The blunder from a few moves back continues to pay negative dividends!

Move number 23: GNU Backgammon to play 62



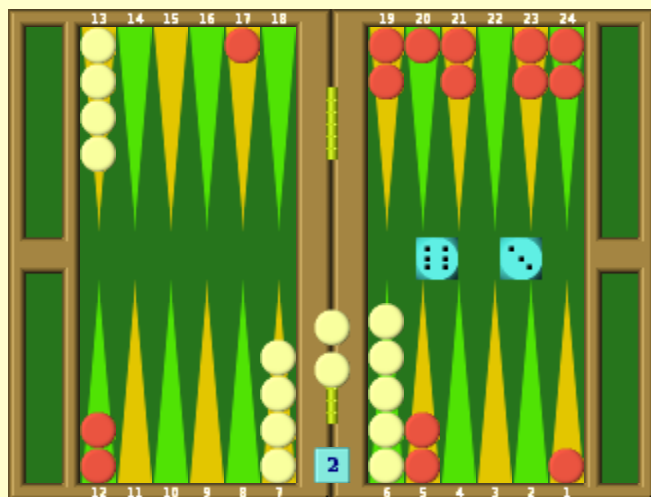
Pip counts: GNU Backgammon 137, opponent 155

• GNU Backgammon moves 13/5*

#	Ply	Move	Equity
• 1	2	13/5*	+0.804
		0.727 0.495 0.009 - 0.273 0.059 0.002	
2	2	13/7 8/6	+0.503 (-0.301)
		0.666 0.347 0.006 - 0.334 0.066 0.002	
3	0	24/16	+0.460 (-0.345)
		0.662 0.311 0.006 - 0.338 0.065 0.002	

Commentary: With a re-made 20 point anchor, and opponent's bear-off board wide open, GNUBG can make high risk/high yield moves that leave blots, without expecting to pay a high price if one its blots is hit. Using the 6-2 to hit the opponent's blot on 5 continues to cost the opponent tempos and keep the opponent off-center with two opponent blots on the bar. If GNUBG makes the 5 point, the opponent's doom may be sealed.

Move number 24: opponent to play 63

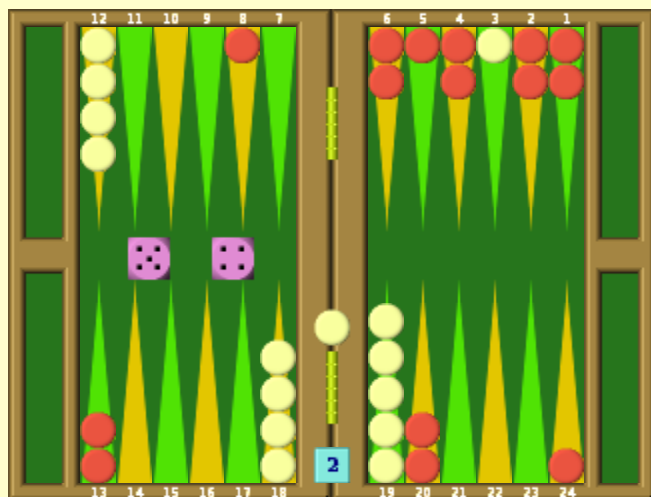


Pip counts: GNU Backgammon 129, opponent 160

- opponent moves bar/22

Commentary: Forced move. Good thing for the opponent that the opponent controls the doubling cube during these perilous times.

Move number 25: GNU Backgammon to play 54



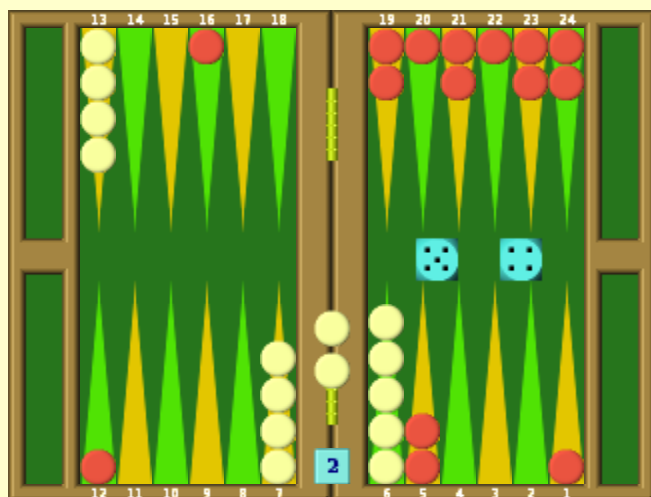
Pip counts: GNU Backgammon 129, opponent 157

- GNU Backgammon moves 13/9 8/3*

#	Ply	Move	Equity
• 1	2	13/9 8/3* 0.712 0.505 0.008 - 0.288 0.072 0.003	+0.763
2	2	20/16 8/3* 0.682 0.451 0.007 - 0.318 0.082 0.004	+0.628 (-0.136)
3	2	24/20 8/3* 0.678 0.433 0.006 - 0.322 0.075 0.002	+0.607 (-0.156)

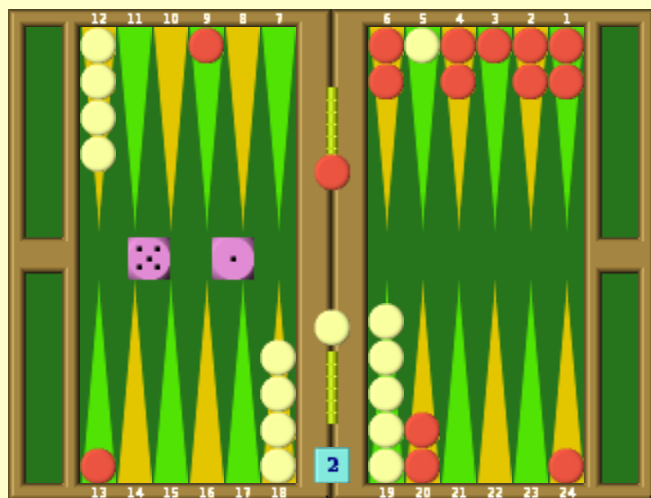
Commentary: No particularly good move options here, and the options are difficult for a human to analyze mathematically. 13/8 13/9 is a relatively safe play, although it breaks the 13 point anchor and leaves the checkers on 20 and 24 exposed to being hit or pointed by the large numbers of opponent checkers/builders on the 12, 18 and 19 points. This play also may give the opponent an ability to recover a tempo if the opponent hits the blot on 5 or even if the opponent just brings in the blot on the bar. GNUBG prefers options where the opponent's blot on 3 is hit, favoring continuing to keep the opponent off-center by keeping two opponent blots on the bar, even if this leaves two blots exposed on GNUBG's bear-off board. After playing the 5 with 8/3*, GNUBG must decide how to play the 4. GNUBG prefers to split the 13 anchor to bring a builder on the 9 point, emphasizing the great importance of having the greatest chance possible of closing out at least one of the blots on the 5 and 3 points. This play risks loss of the 13 point anchor, although with the opponent held down by two blots against a 4-point re-entry board, GNUBG may be able to cover the blot on 13 in the next move or shortly afterwards. If the opponent does not re-enter on the next move, GNUBG will be in a good position to close out one of the blots and have a 5-point bear-off board with two opponent blots on the bar. GNUBG prefers this high risk, high yield move compared to the wimpy 24/20 safety move or the 20/16 move that also, dangerously, removes the 20 point anchor. This illustrates an axiom in Backgammon that if you are forced to leave a blot, an extra offensive play like hitting another opponent blot might be a way to balance the vulnerability of the blot. However, leaving too many blots tends to be dangerous in Backgammon as well, and there are too many blots on the board for GNUBG's sake.

Move number 26: opponent to play 54



- opponent moves bar/20*

Move number 27: GNU Backgammon to play 51



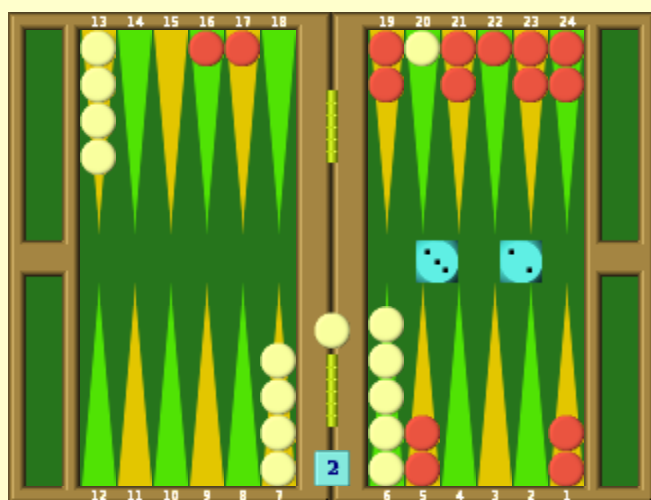
- GNU Backgammon moves bar/24 13/8

#	Ply	Move	Equity
1	3	bar/24 13/8 0.572 0.296 0.003 - 0.428 0.108 0.006	+0.182
2	3	bar/20 4/3 0.564 0.275 0.003 - 0.436 0.119 0.007	+0.129 (-0.054)
3	3	bar/20 24/23 0.557 0.265 0.003 - 0.443 0.116 0.006	+0.109 (-0.073)

Commentary: Another roll that is difficult for the carbon-based Homo-sapien brain-computer to analyze. GNUBG settles again on a high risk offensive play (bar/24, 13/8) in a continued attempt to try to form more points on the bear-off quadrant and possibly close out the opponent while the opponent has one or more blots on the bar. 13/8 brings another blot into position, making two blots (on the 9 and 8 points) available for either closing the point on 3, or hitting the opponent's blot on 5. GNUBG thinks that the best defense is a good offense here, even if there is a risk of having its blot on 3 hit, or either of the blots on 8 or 9 at risk of being hit. However, there is not much added risk of having a blot hit if GNUBG moves the blot on 13 to 8, versus leaving the checker on 13, since by moving 13/8 the checker on 13 is no longer at risk of being hit by the opponent's checkers on 12. The great advantage of having two well-positioned blots on 9 and 8, combined with no significant increase in chance of the blot that was on 13

being hit on the next move, make this play the most attractive to GNUBG. The offense move puts both GNUBG and the opponent in unstable positions, but the opponent's position would be relatively more unstable than GNUBG's position. The instability is relative. Another possibility is bar/24, 9/4, a safe play that removes a blot and brings the blot into the bear-off quadrant. This play greatly reduces the chance of GNUBG hitting the blot on 5, potentially giving the opponent a tempo. Also, only a 1 would allow GNUBG to complete the 3 point on the next move. bar/20, 4/3 returns GNUBG's blot to the game on a more outfield position of the 20 point, versus the further back 24 point. But the choices for the 1, namely 4/3 or 24/23, do not provide GNUBG with offensive advantages, which are critical at this stage for allowing GNUBG to prevent the opponent from entering a racing game. The offensive move at this time makes possible a crushing trapping of the opponent, to assure victory at a time when the PIP counts are similar. 4/3 is better than the pointless 24/23 since 4/3 creates a solid prime structure that removes potentially vulnerable gaps in the middle of the bear-offs. These gaps can become liabilities if later bearing off with an opponent blot located on the 3 point in GNUBG's bear off quadrant.

Move number 28: opponent to play 32

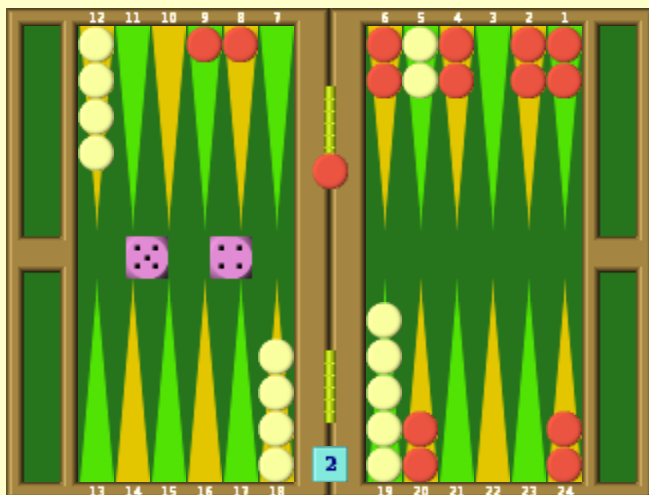


Pip counts: GNU Backgammon 134, opponent 155

• opponent moves bar/22*/20

Commentary: A nice roll that allows the opponent to hit the blot on 22 and form the defensive anchor point on 20. The opponent has suddenly greatly consolidated his position, while GNUBG has a checker on the bar, and two blots on 9 and 8 that now have greatly limited offensive power because there are no opponent blots for them to hit in GNUBG's bear-off quadrant. GNUBG needs a 1 to cover both blots in the next move, but should be able to move at least one of the blots to safety. With GNUBG having 5 checkers back and the opponent in a good position to hit any checkers that GNUBG tries to run, the game is now less favorable for GNUBG.

Move number 29: GNU Backgammon to play 54



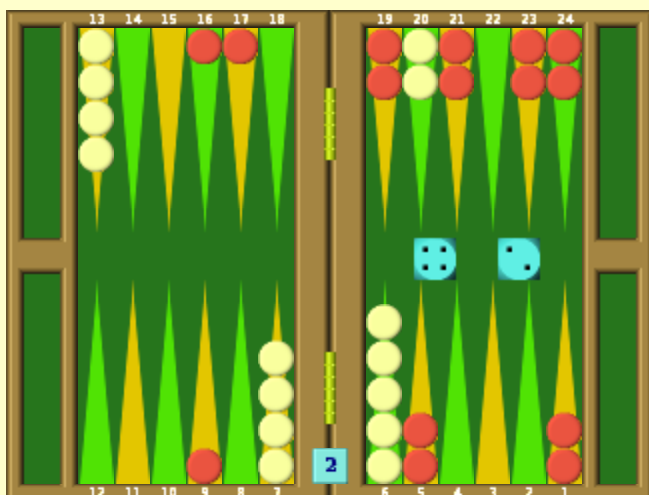
Pip counts: GNU Backgammon 156, opponent 150

• GNU Backgammon moves bar/16

#	Ply	Move	Equity
• 1	3	bar/16 0.415 0.112 0.002 - 0.585 0.156 0.009	-0.427
2	3	bar/21 8/3 0.398 0.111 0.001 - 0.602 0.163 0.009	-0.475 (-0.049)
3	3	bar/20 24/20 0.398 0.107 0.001 - 0.602 0.158 0.007	-0.478 (-0.051)

Commentary: GNUBG prefers to run the checker that was on the bar to the 16 point, instead of using the 5 to move 8/3, which would save the blot on 8 and use that blot as a builder for the 3 point. This shows that GNUBG thinks it is most important in this position to maximize GNUBG's probability of hitting an opponent blot left on the 5 point, if the opponent decides to break the 5 point anchor, than to make the blots on 8 and 9 safe or to form a block on the 3 point. Running to the 16 point also puts a potential builder into an outfield position, which increases the chance of forming an outfield point on the 9 or 8 positions. Bar/21 8/3, if played, would leave a blot on 21, but this is not very risky due to the open board in that quadrant.

Move number 30: opponent to play 42

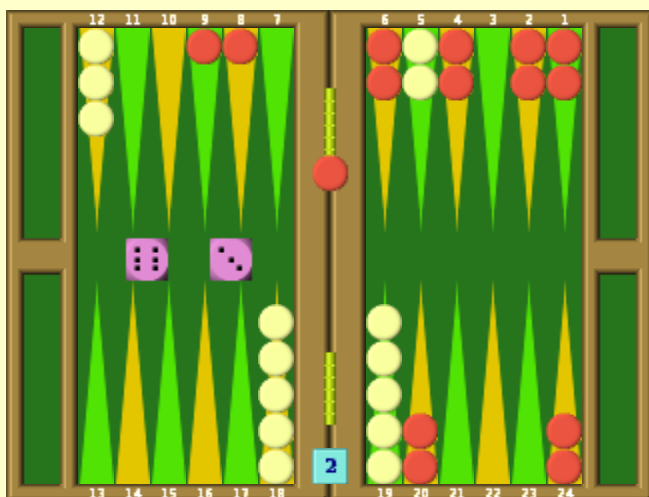


Pip counts: GNU Backgammon 147, opponent 150

• opponent moves 13/9*7

Commentary: Although hitting the blot on 16 will set back GNUBG more than if the blot on 9 is hit, it is too dangerous and premature to break the 20 defensive anchor at this time, which would leave two opponent blots exposed against a 4 point GNUBG bear-off quadrant. The safe play of 13/9*7 is preferred. There is some risk to the opponent of having 5 of GNUBG's checkers in opponent's bear-off quadrant, but this risk of a tricky back game later developing is reduced due to causing GNUBG a loss of tempo by hitting the GNUBG blot.

Move number 31: GNU Backgammon to play 63



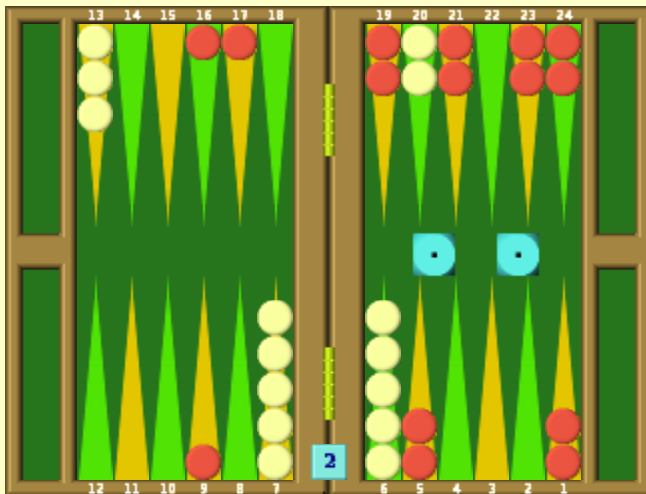
Pip counts: GNU Backgammon 156, opponent 144

- GNU Backgammon moves bar/16

#	Ply	Move	Equity
• 1	3	bar/16 0.417 0.119 0.002 - 0.583 0.157 0.009	-0.417
2	3	bar/22 9/3 0.397 0.104 0.001 - 0.603 0.168 0.010	-0.490 (-0.073)
3	2	bar/22 8/2 0.351 0.085 0.001 - 0.649 0.171 0.008	-0.635 (-0.218)

Commentary: GNUBG again prefers to run the checker instead of securing a blot by moving 9/3 or 8/2 with the 6. GNUBG wants blots on 9 and 8 to be in a strong offense position to hit a blot on 5 if the opponent breaks the opponent's defensive anchor on the 5. GNUBG probably thinks there is little general danger of having a blot hit with the opponent's bear-off board open. With 4 checkers forming points on the 20 and 24, GNUBG has a chance of waging a strong back game war if more checkers were sent back. Note how GNUBG ranks 9/3 higher than 8/2. This illustrates two basic Backgammon axioms that a block on the 3 point in the bear-off quadrant is more useful than a block on the 2 point, and the placement of a builder on a previously empty space in the bear-off quadrant (in this case, the 3 point) is more useful than leaving that space empty and instead piling up checkers on another space (in this case, the 2 point).

Move number 32: opponent to play 11



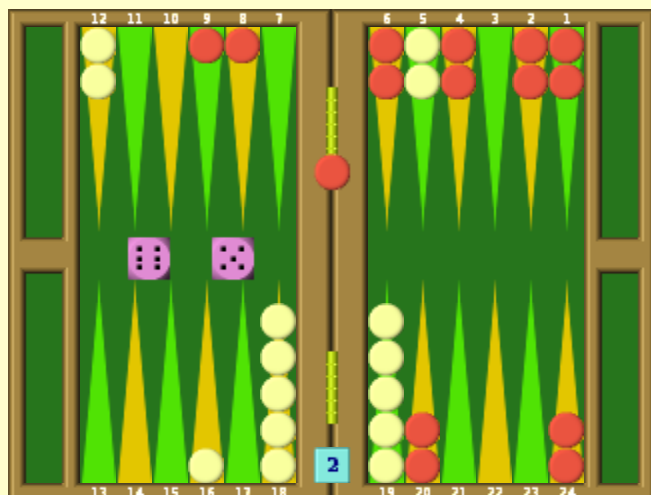
Pip counts: GNU Backgammon 147, opponent 144

- opponent moves 13/9*

Commentary: The safe move is 13/12 13/12 13/12 7/6, which may be appropriate given the danger to the opponent of GNUBG hitting one of the opponent's blots when there are four GNUBG points in GNUBG's bear-off quadrant. All other alternatives leave a blot. An offensive move to cost GNUBG a tempo may be best,

to give the opponent some opportunity to start building points on the opponent's bear-off board. 13/9* is therefore preferred. If a player is compelled to leave a blot on the board, ideally the blot is left while simultaneously hitting the other player's blot and sending the other player on the bar to reduce the probability of the other player hitting back the blot.

Move number 33: GNU Backgammon to play 65



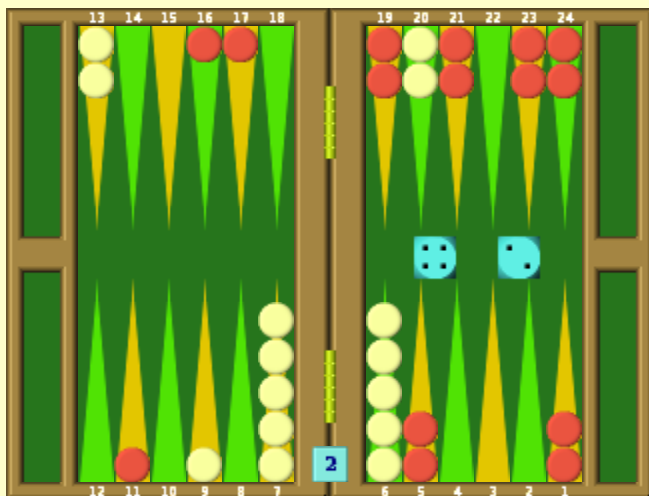
Pip counts: GNU Backgammon 156, opponent 140

• GNU Backgammon moves bar/14

#	Ply	Move	Equity
• 1	3	bar/14 0.411 0.108 0.002 - 0.589 0.165 0.010	-0.456
2	3	bar/20 9/3 0.389 0.096 0.001 - 0.611 0.167 0.009	-0.523 (-0.067)
3	2	bar/20 8/2 0.346 0.078 0.001 - 0.654 0.171 0.007	-0.656 (-0.201)

Commentary: Another attempt to run instead of using the other dice number to secure one of the blots on 8 and 9.

Move number 34: opponent to play 42



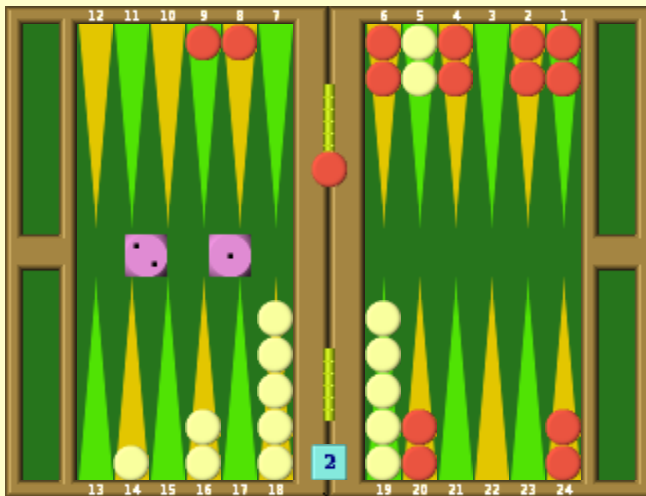
Pip counts: GNU Backgammon 145, opponent 140

• opponent moves 13/11* 13/9

Commentary: One option is the aggressive 20/16* 13/11*. Double blot hits can be powerful moves in Backgammon, and feature a low chance of the opponent being able to hit back on the next roll. The offensive play is not necessarily a bad move, although it leaves five blots, perhaps too many, with the need to return into a dangerous four-point bear-off board if one of the blots is hit later on. This move potentially can allow the opponent to build up blocking points on the opponent's bear-off quadrant via the opponent hitting GNUBG's blots as they re-enter while also forming anchors or builders on those blots during the blot hitting process. Various builders would also increase the chance of the opponent rolling rolls that allow the opponent to form blocking points in the opponent's bear-off quadrant. However, if GNUBG brings back both, or even just one blot, into the game, GNUBG may have just enough stability in the position to be able to launch an offensive against the opponent's multiple free blots on the board, which the opponent may have trouble getting to safety because there are so many blots. If an opponent's blot is hit, any delay in the opponent returning a blot gives GNUBG the chance to hit another opponent blot, resulting in two blots back against a four-point bear-off board and an almost guaranteed victory for GNUBG. This danger is increased due to breaking the 20 point defensive anchor in order to hit the blot on 16, an anchor which is vital for safely bearing in at least some of the blots. 13/9 13/11* combines safety with offense. The 20 point defensive anchor stays intact, only 1 opponent blot is exposed on 11 and GNUBG's blot is hit. In addition, a useful outfield anchor is created on the 9 point, which helps to block the checkers on the 5 point from escaping, and provides a safety point for storing builders for creating more critically needed points on the opponent's bear-off board, with the possibility of forming an outfield prime using the 6, 7, and 9 points. This move consolidates the opponent's board position such as to provide

a better chance for the opponent to safely move the checkers on the 20 point towards the bear-off quadrant when the opponent decides to break the 20 point anchor (an event which should happen soon). There is also the convenient opportunity for the opponent to hit one of the blots on 16 and 17.

Move number 35: GNU Backgammon to play 21



Pip counts: GNU Backgammon 156, opponent 134

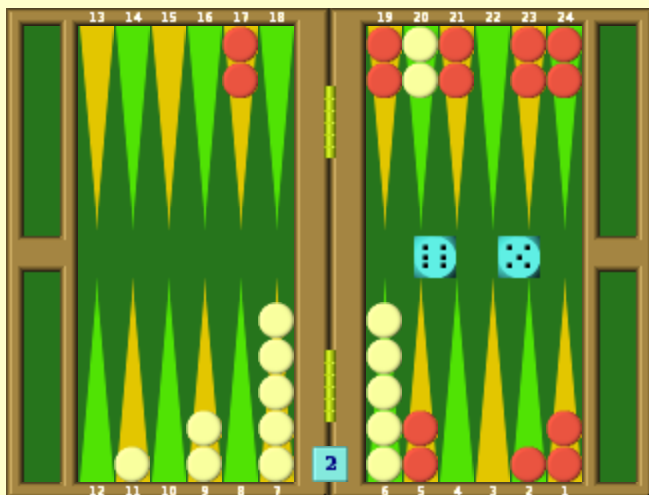
• GNU Backgammon moves bar/23 9/8

#	Ply	Move	Equity
• 1	2	bar/23 9/8 0.405 0.090 0.001 - 0.595 0.151 0.007	-0.470
2	2	bar/23 8/7 0.373 0.092 0.001 - 0.627 0.194 0.013	-0.599 (-0.130)
3	2	bar/23 24/23 0.373 0.086 0.001 - 0.627 0.191 0.010	-0.605 (-0.136)

Commentary: GNU Backgammon chose to consolidate its position by converting the blots on 9 and 8 into a blocking point. This safe move has the drawback of reducing the numbers of rolls that would allow GNUBG to hit on the 5 point if the opponent broke the 5 point anchor. However, the opponent is not likely to break the 5 point anchor in the near future, since the opponent will likely use the next few moves to try to build blocking points in the opponent's bear-off board, so. The opponent also does not need to break the 5 point anchor in the near future because the next two quadrants are wide open for running the checkers on the 5 point. There is low risk now of those 5 point checkers being closed out if the anchor is not broken soon to try to run the checkers. By keeping these blots on 9 and 8 at this time, GNUBG has big risks without necessarily having a chance at hitting an opponent blot on 5, because so many of the opponent's builders are now in position to quickly make blocking points in the opponent's bear-off quadrant. Moving 8/7 with the 1 maintains the risk of one of those blots being hit, of course. Bar/24 9/7 is similar to bar/23 9/8, but GNUBG did not consider this

move as one of its top three options. GNUBG apparently thinks it is better to diversify checkers on 23 and 24, instead of putting all the checkers on 24. This diversity gives GNUBG a greater chance of getting a good running roll to run one of the back checkers, and increases the chance of GNUBG hitting a blot if the opponent leaves a blot on the bear-off board in an attempt to begin making a bear-off board anchor.

Move number 36: opponent to play 65

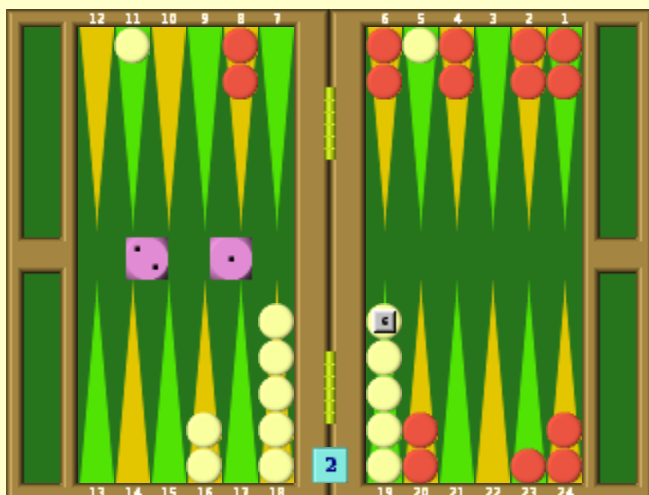


Pip counts: GNU Backgammon 153, opponent 134

• opponent moves 20/14 11/6

Commentary: An awkward roll given that playing a 6 forces leaving a blot, and a 6 cannot be played by the checkers on the 11, 6 and 7 points. Playing the 6 with the checker on 9 leaves too many blots. The opponent is therefore essentially forced to use the 6 to move a checker from the 20 point, breaking the anchor. Now, how to play the 5? With four GNUBG points on GNUBG's bear-off board, leaving multiple blots is dangerous, especially since the hitting of one blot by GNUBG can lead to the hitting of a second blot by GNUBG on subsequent rolls, leading to almost guaranteed victory for GNUBG. Reducing the numbers of blots becomes a key necessity in this position. This makes 7/2* too dangerous to play. A consolidating move of 11/6 removes that one blot on 11, so that only the blots on 20 and 14 are exposed, and only the blot on 20 is exposed to a direct shot. At least if the blot on 20 is hit, there is minimal PIP loss, since the blot is so far back. Meanwhile, it is unlikely that GNUBG can hit both blots over the next two rolls, which gives the opponent a chance at re-consolidating his position if the blot on 20 is hit. GNUBG will have some trouble covering the blot that it would leave on 20 if it hit on 20, due to GNUBG's lack of builders in the neighborhood.

Move number 37: GNU Backgammon to play 21



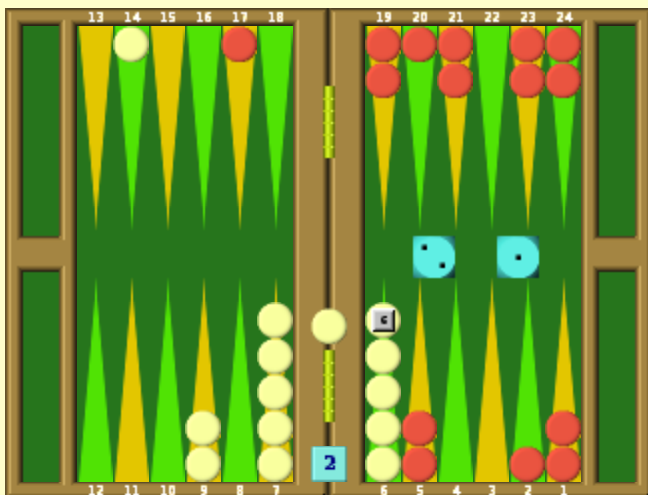
Pip counts: GNU Backgammon 153, opponent 123

• GNU Backgammon moves 8/5*

#	Ply	Move	Equity
• 1	2	8/5*	-0.201
		0.478 0.190 0.003 - 0.522 0.153 0.011	
2	2	24/23 24/22	-0.476 (-0.275)
		0.390 0.100 0.002 - 0.610 0.137 0.005	
3	2	24/22 23/22	-0.479 (-0.278)
		0.386 0.099 0.002 - 0.614 0.133 0.004	

Commentary: GNUBG decides on an offense move of simultaneously hitting and slotting on the 5, while leaving a builder blot on the 8. Although the move is risky, it provides a considerable advantage if the opponent fails to re-enter or hit the blot, and GNUBG then covers the blot. GNUBG decides against two other safety move choices, which would form points on the 23 or 22 positions. These moves would give the opponent a tempo and not achieve any particularly useful advantage. GNUBG thinks that the move that forms a point on 23 is slightly better than the move that forms a point on 22. The two moves might be essentially equal, but this equality may not show in the rollout that GNUBG performed to analyze the roll choices. The point on 23 may restrict the opponent's mobility slightly more than the point on 22, since the point on 23 blocks a roll of a 5 for the checkers on 19. Moving 23/20 removes the checker on 23, which reduces the chance of GNUBG being able to hit a builder blot that the opponent may later leave in the bear-off quadrant.

Move number 38: opponent to play 21

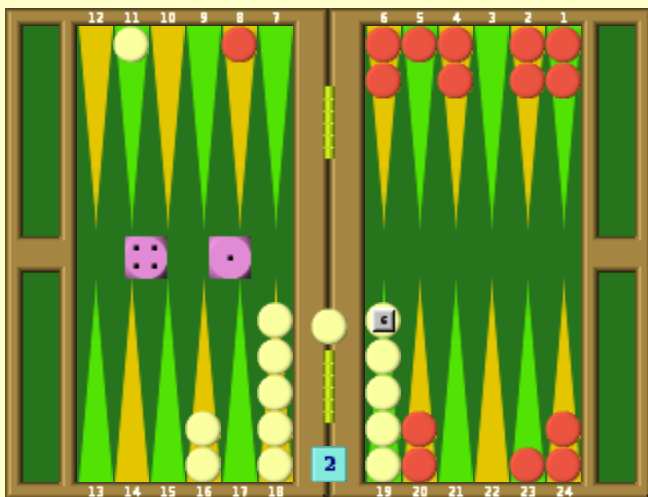


Pip counts: GNU Backgammon 150, opponent 128

- **opponent cannot move**

Commentary: The opponent cannot bring in the blot. GNUBG now has a chance at closing the point on 20. The noose is tightening.

Move number 39: GNU Backgammon to play 41



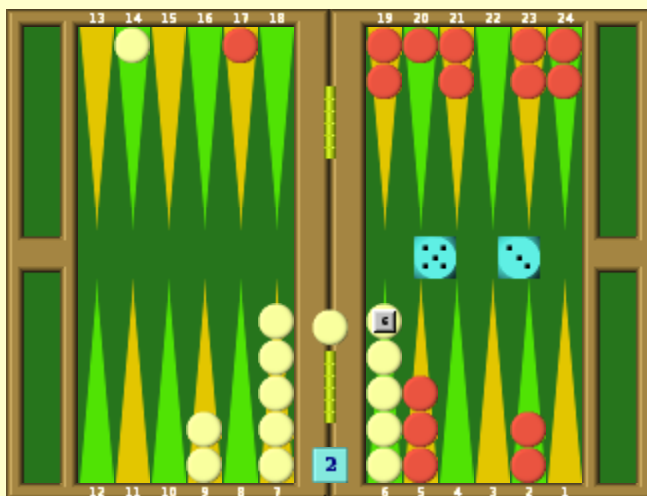
Pip counts: GNU Backgammon 150, opponent 128

- **GNU Backgammon moves 24/23 24/20**

#	Ply	Move	Equity
• 1	3	24/23 24/20 0.492 0.192 0.003 - 0.508 0.132 0.005	-0.137
2	3	24/20 23/22 0.488 0.199 0.003 - 0.512 0.148 0.007	-0.156 (-0.019)
3	3	24/20 8/7 0.484 0.200 0.003 - 0.516 0.156 0.008	-0.171 (-0.034)

Commentary: An awkward roll that does not allow GNUBG to cover the 5 point blot. Moving 8/4 to make the blot on 8 safe is counter-productive in a statistical sense, since this eliminates the key builder for closing the blot on the 5 point and making both blots safe, and gaining the big advantages of making the 5 point. GNUBG should best leave the blots on 5 and 8 in place, as if re-running the nail-biting risk of leaving them exposed from the last move. GNUBG chooses 24/23 24/20 to consolidate GNUBG's position in the opponent's bear-off quadrant, and remove blots there to prevent being "under the gun." 24/20 23/22 has the advantage of keeping more checkers distributed on more spaces, so that more checkers are ready to hit any builder blots that the opponent leaves in the opponent's bear-off quadrant. However, this play leaves too many blots. 24/20 8/7 is problematic because moving 8/7 reduces the number of rolls that GNUBG will have to cover the 5 point on the next move. If 8/7 is played, only a 2 roll will allow GNUBG to cover the blot on 5 with the spare checker on 7. Keeping the spare checker on 8 allows any 3, and a roll of 2-1 or 1-2 to cover the point. Coverage of the point would provide such a big advantage that the small reduction in the chance of covering the blot on 5 by moving 8/7 removes 8/7 as an acceptable choice.

Move number 40: opponent to play 53

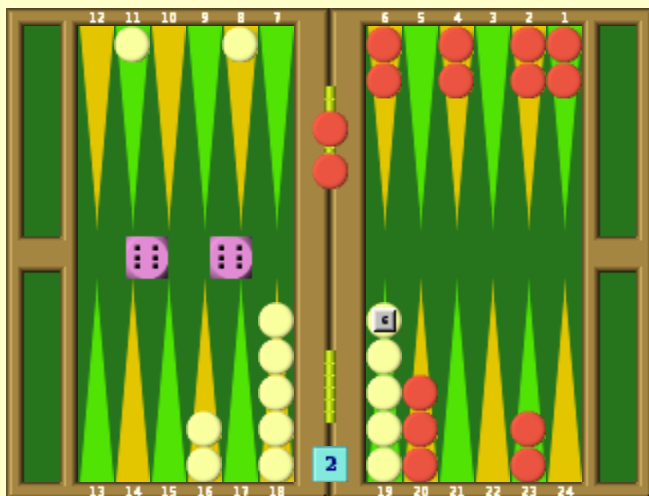


Pip counts: GNU Backgammon 145, opponent 128

- opponent moves bar/20*/17*

Commentary: A powerful roll that allows the opponent to not only bear in, but to hit both of GNUBG's blots. The opponent's position has suddenly become much more consolidated! Don't you just love miracle rolls in Backgammon?

Move number 41: GNU Backgammon to play 66



Pip counts: GNU Backgammon 182, opponent 120

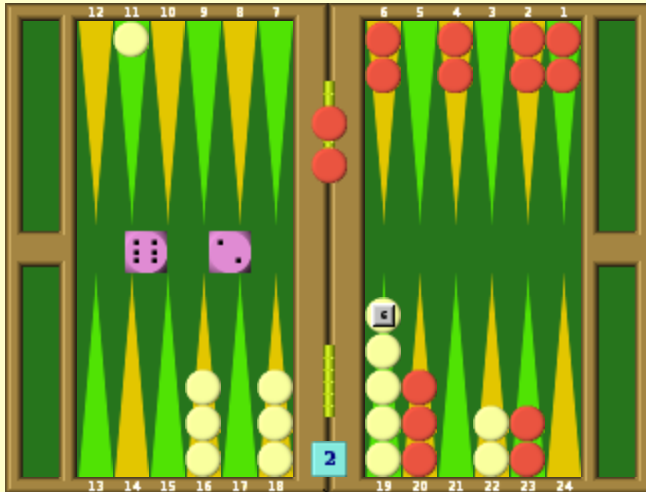
- GNU Backgammon cannot move

Commentary: 6-6!!! A second miracle roll in a row, miraculously bad for GNUBG! The temptation may now be for the opponent to re-double. Good thing GNUBG is just a silicon computer with no heart. If it were human, it would be screaming on the inside, although hopefully while showing an outwardly polite, quiet, professional, perhaps slightly smiling or grimacing, "losing with grace" poker face.

- opponent moves 17/9 7/3(2)

Commentary: Another fine roll that gives an opportunity to make a badly needed anchor in the bear-off quadrant, playing 7/3(2). The other two 4's are best used for 17/9, which puts a builder on the 9 point, secures the blot on 17, and moves the opponent into a strong racing position. The opponent needs to form anchors in the bear-off quadrant to give some ability to handle the large number of GNUBG's checkers that are in the bear-off quadrant. Those checkers can lead to a nasty backgame against the GNUBG's powerful 4-anchor bear-off quadrant. Moving 14/6 with the two 4's is not useful since it does not contributed to putting builders near the bear-off board, and there are too many checkers bunched on the 6 point anyway. Distributing builders on multiple safe anchors, to provide at each turn some chance of forming a blocking point, is a key tactic in Backgammon. Otherwise, 14/7 is an efficient racing move since the opponent crosses two quadrants with this move without wasting a pip, by landing exactly one pip inside the second and bear-off quadrant. In general, in Backgammon, positioning builders to make anchor points to use for gaining pips against the opponent by slowing down the opponent and obstructing the opponent's mobility is more important than racing. However, the expert player should also know at what point during a game this axiom no longer holds, that is, at what point pure racing moves become more important than anchor-forming moves.

Move number 43: GNU Backgammon to play 62

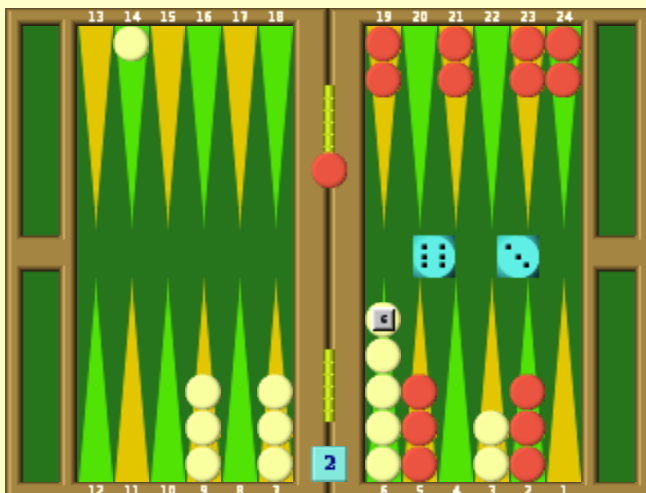


Pip counts: GNU Backgammon 182, opponent 104

- GNU Backgammon moves bar/23

Commentary: Forced! At this point, the opponent is considering doubling. However, since GNUBG can potentially play a strong backgame against a 4-point anchor board, there is a risk of a disaster occurring later on for the opponent, and GNUBG would be holding the cube during that possible disaster. Still, the opponent's carbon-based brain computer may not be analyzing the situation rationally and perhaps should be doubling.

Move number 44: opponent to play 63

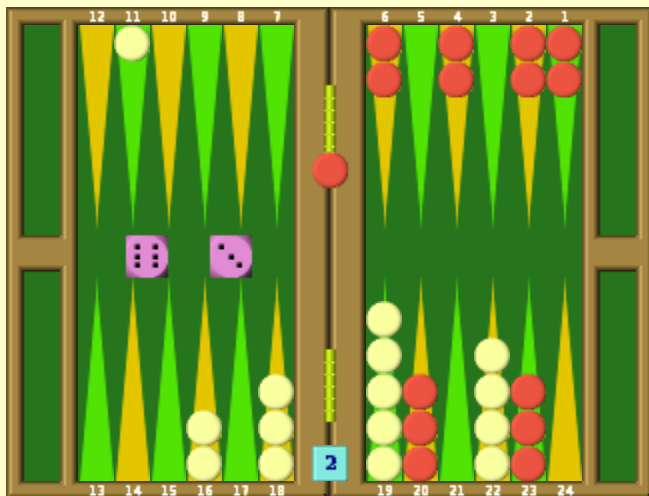


Pip counts: GNU Backgammon 180, opponent 104

- opponent moves 9/3 6/3

Commentary: The safe play may be appropriate given GNUBG's 4-point bear-off board. Another possibility is 14/8, 6/3, which creates a blot builder on the 8 point. There are a variety of point-forming rolls that could occur for the opponent on the opponent's next move, if GNUBG does not hit the blot on 8 on GNUBG's next move, but a disaster could occur for the opponent if the blot is hit. If GNUBG hit the opponent's blot on 8, GNUBG could then pour blots into the outfield from 10-18, so that not only would the opponent have a difficult time bearing in, but the opponent's blot would probably be hit again if the opponent attempted to escape the blot. Meanwhile, more GNUBG blots in the outfield would provide GNUBG with builders to close out the opponent's lone blot in GNUBG's bear-off quadrant. There are enough hitting rolls for GNUBG to make 14/8, 6/4 possibly too dangerous, but it is a move with solid racing game advantages. If the opponent had more anchors in the opponent's bear-off quadrant, taking this risk might be more justified.

Move number 45: GNU Backgammon to play 63

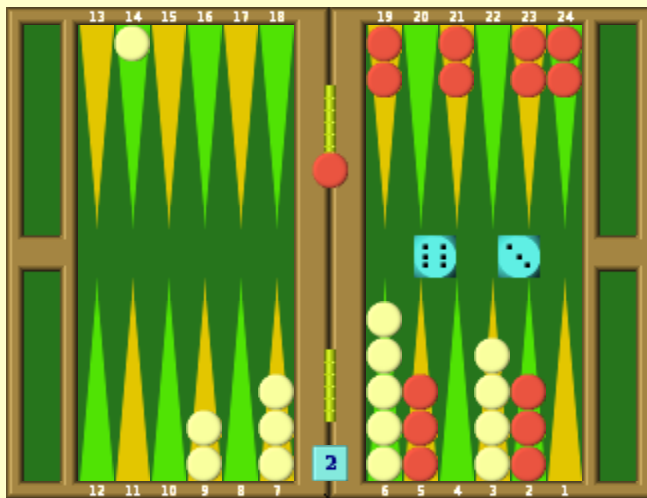


Pip counts: GNU Backgammon 180, opponent 95

- GNU Backgammon cannot move

Commentary: GNUBG dances.

Move number 46: opponent to play 63

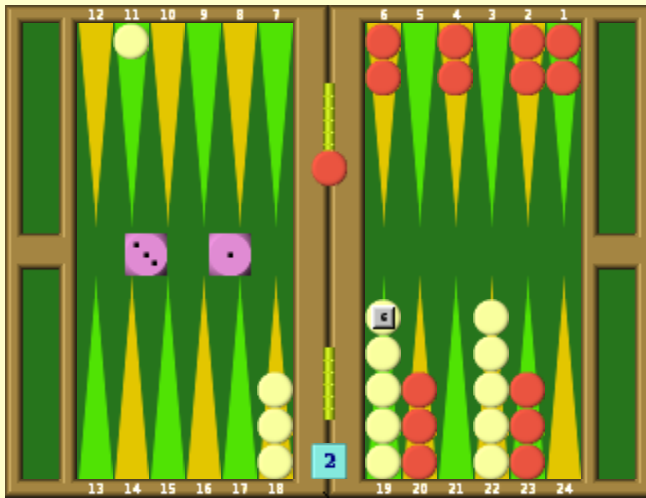


Pip counts: GNU Backgammon 180, opponent 95

• opponent moves 9/6 9/3

Commentary: There is some temptation to play a "pay now, pay later" move of slotting a builder in the bear-off quadrant, such as with 7/1 14/11, or a slightly safer 7/1 6/3, or to move 14/8 6/3. However, leaving blots may be too dangerous at this time. Minimizing the chance of a blot being hit is a key priority in this tricky situation. 14/8 6/3 would probably not be a bad move, and might be the best move. The opponent played the "pure, safe" play of 9/6 9/3. This racing move removes the anchor on the 9 point, potentially a key anchor in bringing the blot on 14 home safely. It is almost premature, or perhaps just barely timed right, to break the anchor at this time. The opponent would need a 7, 8 or 11 on the next move to bring the blot on 14 to a safe anchor. Fortunately, 7 is the most statistically frequent two-dice number combination. But the next two moves will be critical in deciding whether or not the opponent will leave an exposed blot that gets hit. Lots of GNUBG checkers are nicely positioned to hit the blot on 14 if the opponent does not get some big numbers on the next move. The opponent's bear-off process will have some risk in it due to the opponent's wide-open bear-off quadrant. With some luck, however, the position will swing clearly enough in the opponent's favor to justify a clear double. However, if GNUBG brings the blot in next move, and the opponent hits a low number die roll in the move after that, the opponent's blot on 14 will be stuck in the outfield, without the 9 point anchor as a potential safe point, and with lots of GNUBG checkers in position to hit the opponent's outfield blot.

Move number 47: GNU Backgammon to play 31



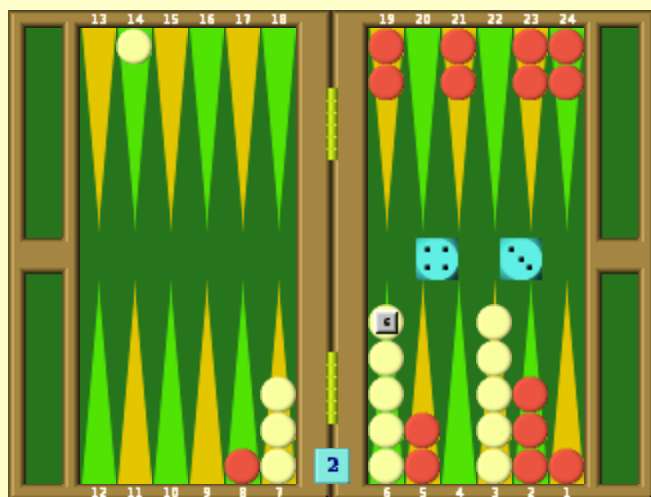
Pip counts: GNU Backgammon 180, opponent 86

- GNU Backgammon moves bar/24 20/17

#	Ply	Move	Equity
• 1	2	bar/24 20/17 0.401 0.055 0.001 - 0.599 0.325 0.026	-0.713
2	2	bar/21 0.379 0.050 0.001 - 0.621 0.344 0.022	-0.854 (-0.140)
3	2	bar/24 23/20 0.369 0.055 0.001 - 0.631 0.355 0.020	-0.914 (-0.201)

Commentary: Bar/24 20/17 positions a GNUBG blot on the 17 point, which gives that blot a direct 6 shot at the opponent's blot on 11. The blot on 17 can also be hit, but the cost of this is small due to the opponent's open bear-off quadrant. The big advantage of hitting the opponent's blot is that the opponent may be delayed in the bear-in of the blot, while GNUBG puts checkers in the outfield so that they are ready to hit the opponent's blot if the opponent bears in and tries to escape that checker. This tactic may lead to GNUBG's victory. Maximizing the probability of hitting the opponent's blot becomes the key tactic in this position, hence the need to position a GNUBG blot on 17 to give the GNUBG blot a direct shot at the opponent's blot on 11. Bar/21 puts a spare GNUBG blot on 21, which also has some chance of hitting the opponent's blot on 11. However, hitting the opponent's blot would require an indirect shot, so there is much less chance of GNUBG hitting the opponent's blot, and the GNUBG blot on 21 is "under the gun" and can be hit by builders coming from the 18 and 19 points. bar/24, 23/20 is the safe play, but does not put any GNUBG blots in position to help hit the opponent's blot on 11. This gives this play less of an advantage compared to plays that increases the chances of hitting the opponent's blot.

Move number 48: opponent to play 43



Pip counts: GNU Backgammon 176, opponent 86

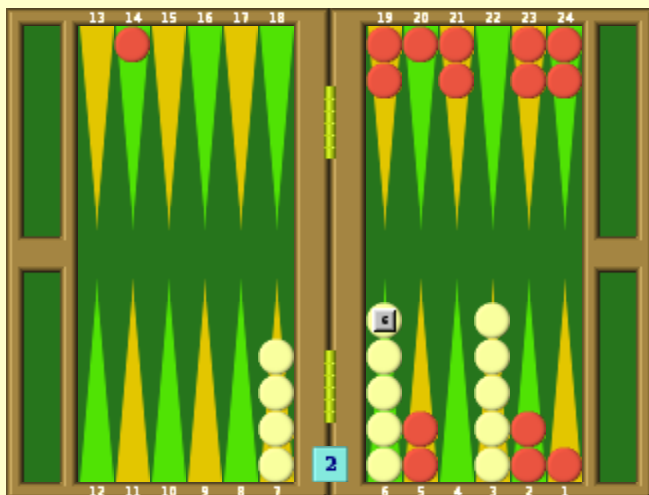
• opponent moves 14/7

Commentary: A running move that removes the opponent's dangerous liability of having a blot on 14. The game is at a critical point, in that the opponent must be able to bear in against multiple GNUBG checkers in the opponent's bear-off quadrant, but with only two opponent anchors in the quadrant. The risk is that the opponent may leave a blot that gets hit at a time when GNUBG may have been able to add more blocking points to GNUBG's bear-off board. If the opponent can make one or two more anchors in the bear-in quadrant, that would greatly simplify and make more safe the opponent's bear-off process. If the opponent wants to put a builder in the opponent's bear-off quadrant to make an anchor point, the opponent has less chance of being hit if the opponent puts a builder on the opponent's 1 point, by hitting the blot on the 1 and simultaneously placing a builder there. If the opponent did this, only a 1 roll would allow GNUBG to hit that opponent blot, but if the opponent put the blot on the 4 point, GNUBG would have a much higher chance of hitting the opponent's builder blot.

- **GNU Backgammon moves 23/5 17/11**

Commentary: GNUBG used this roll to place a builder on the 5 point, while moving 17/11 to put a blot on 11 that gives that blot a direct 6 shot at closing the 5 point. GNUBG prefers this move due to wanting to follow a strategy of trying to close off GNUBG's bear-off quadrant as soon as possible, so that if the opponent leaves a blot during the bear-off process, the opponent risks a huge setback if the blot is hit. Any other way of playing 6-6 requires breaking either the 20 or 23 anchors. These anchor-breaking moves put several GNUBG checkers in the outfield so that they are poised to hit an opponent blot if an opponent blot is hit, bears in, and the opponent tries to escape the blot. These outfield positioning moves also help to run back checkers to reduce the chance of GNUBG being gammoned. However, it is premature and dangerous for GNUBG to break anchors at this time. The anchors increase the awkwardness of the opponent's bear-off process, and breaking the anchors creates GNUBG blots that are "under the gun" and can be hit, with the opponent either replacing a hit GNUBG blot with a builder, or with some lucky rolls a blocking point. GNUBG wants to keep its checkers back for now, to increase the chance of hitting any errant blot that the opponent may leave in the opponent's bear-off quadrant.

Move number 50: opponent on roll, cube decision?



Pip counts: GNU Backgammon 152, opponent 79

- opponent doubles to 4
- and GNU Backgammon accepts the double

Cube decision

3-ply cubeless equity +0.549

0.638 0.303 0.015 - 0.362 0.044 0.000

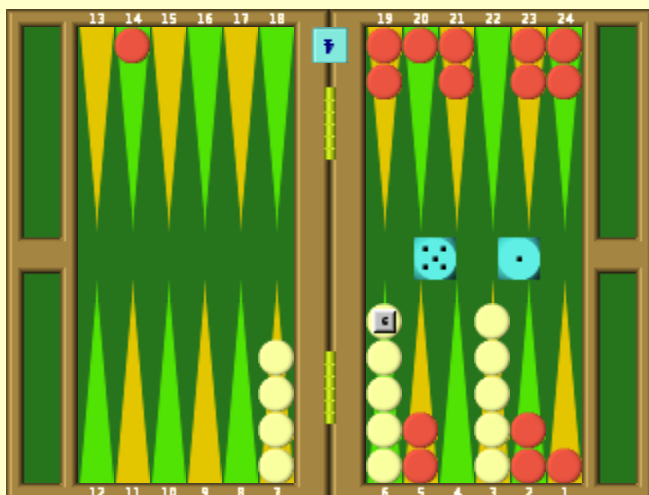
Cubeful equities:

1. Double, take +0.852
2. Double, pass +1.000 +0.148
3. No double +0.810 -0.042

Proper cube action: **Redouble, take**

Commentary: The opponent will probably win, but there is some risk of losing to a back game. This makes both doubling and taking to be rational. The advantage of doubling may be a bit small, due to the opponent losing possession of the doubling cube to GNUBG.

Move number 52: opponent to play 51

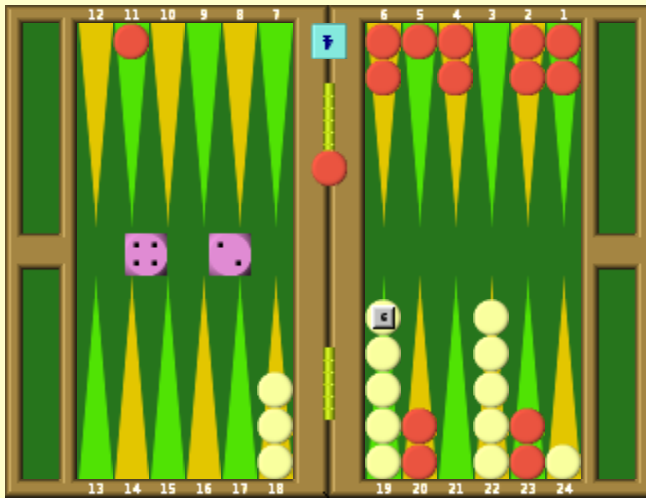


Pip counts: GNU Backgammon 152, opponent 79

- opponent moves 7/1*

Commentary: Forced move. Slotting on the blot on the 1 point is a desirable move since it provides a deep bear-off board anchor that is basically guaranteed to be a safe haven for any checkers that land on it, since (obviously) GNUBG cannot put any blot checkers behind it. As always, slotting while hitting tends to be a strong move in Backgammon. Even if the 5 was not forced, this move would be recommended as a "pay now, pay later" move. Sooner or later, the awkwardness of having GNUBG on the 1 point will make it difficult for the opponent to bear in without risk of being hit by that blot. Get the GNUBG blot out of there, and try to form a point on that spot, now. At least GNUBG has a blot on 20 that might be hittable if the slotted opponent blot on 1 is hit.

Move number 53: GNU Backgammon to play 42



Pip counts: GNU Backgammon 153, opponent 73

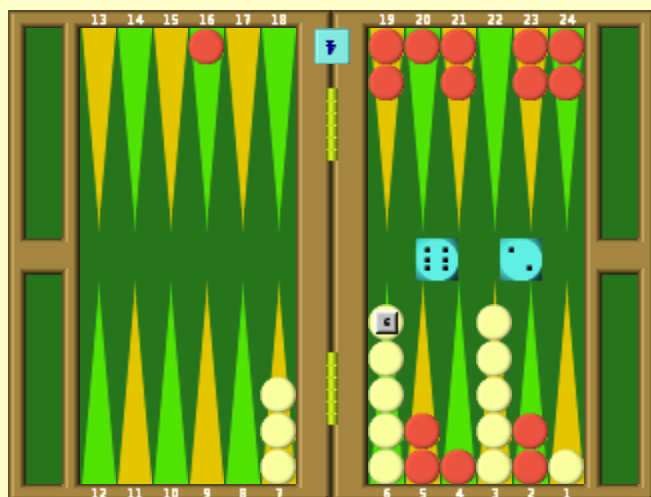
- GNU Backgammon moves bar/21 11/9

#	Ply	Move	Equity
• 1	2	bar/21 11/9 0.379 0.037 0.001 - 0.621 0.302 0.012	-0.389
2	2	bar/21 5/3 0.354 0.034 0.000 - 0.646 0.322 0.013	-0.473 (-0.084)
3	2	bar/23 11/7 0.342 0.026 0.000 - 0.658 0.295 0.011	-0.480 (-0.091)

Commentary: GNUBG needs to hit one of the opponent's blots while having five anchors on the GNUBG bear-off quadrant. The anchors on 20 and 23 provide a safe base of operations from which to hit any blots that the opponent leaves on the 22, 21, 20 and 19 points during the opponent's bear-off period. It is best to keep the anchors on 20 and 23 for now, which also help to prevent the opponent from forming points on the opponent's bear-off board and make it more awkward for the opponent to bear in without leaving blots. To increase the chance of closing the blot on 5, GNUBG wants its spare checker on 11 to be as far away from the blot as possible while still being able to land on the blot with a single number of the dice. Now, it is 6 away, which is ideal. GNUBG is pressured to move that checker in further, either using the 4 or 2 dice number. Moving it with the 2 number keeps it 4 away from the blot on 5, for which there is greater chance of covering the blot on 5 compared to if the checker was moved with the 4 to the 7 position. Generally, then, 11/9 is superior to 11/7. bar/21 11/9 is therefore better than bar/23 11/7. Bar/21 increases the distribution of GNUBG checkers in the opponent's bear-off quadrant, giving GNUBG extra chances to hit blots. If GNUBG leaves a blot on 21, the opponent may hit the blot, giving GNUBG a chance to hit

the opponent's blot on the 24 point on the next move coming in from the bar. Bar/23 would put GNUBG's checker far back in the opponent's bear-off quadrant, making it more difficult for GNUBG to escape that checker, and there would only be two points occupied by GNUBG in the opponent's bear-off quadrant to use for hitting any blots that the opponent may leave. Bar/21 5/3 is problematic since moving 5 to 3 shifts GNUBG's builder blot from the 5 spot to the 3 spot. A block on the 3 point is less valuable than a block on the 5 point for GNUBG. There would be little to prevent the opponent from escaping a blot that was on the 5 point of GNUBG's bear-off quadrant, compared to if the blot was on the 3 point. A fourth choice in this position is bar/21, 23/21, which forms an anchor on the 21 point, and breaks the anchor on the 23 point, while maintaining the 6 away distance of the GNUBG blot on 11. The anchor on 21 is less useful than the anchor on the 23 point, which is further back and has greater chance of hitting blots left by the opponent. The opponent can also hit and slot on the GNUBG blot on 23, potentially forming anchors on the 23 and 24 points, which would make the bear-off process considerably safer.

Move number 54: opponent to play 62



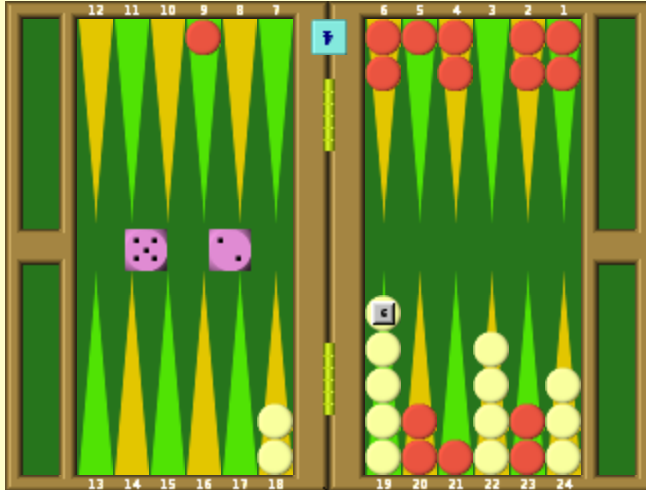
Pip counts: GNU Backgammon 147, opponent 73

- opponent moves 7/1 3/1

Commentary: The 6 is forced and allows the opponent to cover the much needed safe anchor on the 1 point. The opponent decided to play the safe move of 3/1 with the 2, since hitting the blot on 4 is too costly given the risk of a being closed out if the opponent's blot is hit. However, 6/4, which simultaneously hits and slots, is not necessarily a bad move but more like a "pay now, pay later" move where sooner or later the opponent may be forced to leave a blot if the opponent does not form more anchors in the opponent's bear-off quadrant. Slotting while hitting gives some chance of hitting GNUBG's builder blot on 20, as a response if GNUBG hits the opponent's blot on 4 during the bear-in. Some players might play 6/4. However, GNUBG's timing is not great and GNUBG is at risk of breaking GNUBG's anchors on GNUBG's bear-off quadrant if GNUBG does not start running

checkers soon. The more checkers GNUBG runs, in general the safer will be the opponent's bear-in process, although there are still some theoretical statistical dangers that lie ahead for the opponent during the bear-off process.

Move number 55: GNU Backgammon to play 52



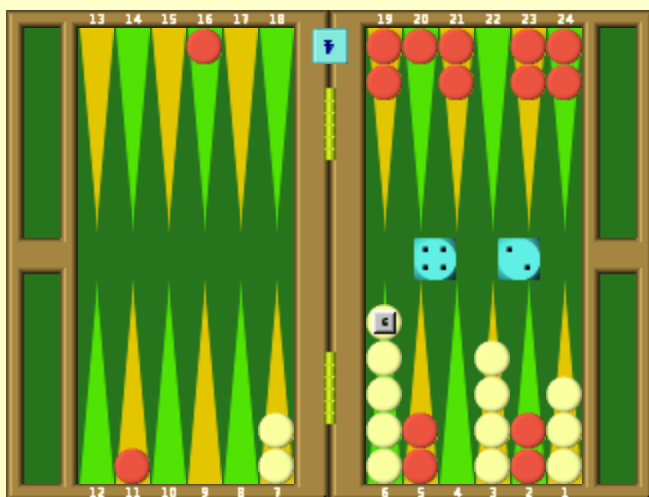
Pip counts: GNU Backgammon 147, opponent 65

• GNU Backgammon moves 21/14

#	Ply	Move	Equity
• 1	3	21/14 0.336 0.030 0.000 - 0.664 0.294 0.008	-0.485
2	3	21/16 9/7 0.320 0.027 0.000 - 0.680 0.305 0.009	-0.536 (-0.051)
3	3	20/13 0.337 0.039 0.000 - 0.663 0.378 0.015	-0.564 (-0.079)

Commentary: 5-2 is usually the most awkward combination roll in backgammon. No matter where one is in the game, a 5-2 roll often just does not "fit right." 6-6 often is not that great either since it often forces awkward moves or pointless pure running plays. There are exceptions to all generalizations, of course. Here, GNUBG cannot cover the blot on the 5 point, and prefers not to move 9/7 with the 2 due to there being fewer rolls that allow the checker on 7 to cover the blot on 5, compared to if the checker stayed on the 9. Breaking the 20 anchor is premature and potentially dangerous. The pure running play of 21/14, which removes the 21 blot from danger, is best.

Move number 56: opponent to play 42

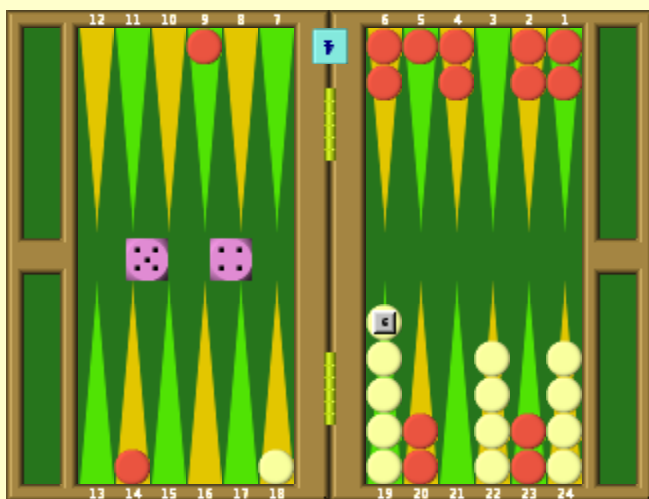


Pip counts: GNU Backgammon 140, opponent 65

- opponent moves 7/1

Commentary: A forced move that leaves a blot on 7 with two single numbers rolled by GNUBG would enable GNUBG to hit the blot. The game has suddenly become more dangerous for the opponent. If the blot on 7 is hit, which will occur with over a 60% probability, that hit checker will have to navigate through a jungle of GNUBG anchors and checkers to get back to the bear-off quadrant. GNUBG might be tempted to double at this point, although GNUBG may be doomed if it does not hit the opponent's blot on the next move.

Move number 57: GNU Backgammon to play 54



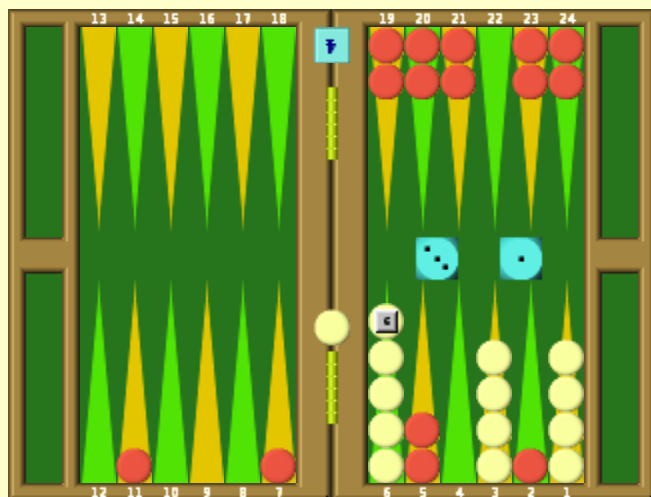
Pip counts: GNU Backgammon 140, opponent 59

• GNU Backgammon moves 23/18* 9/5

#	Ply	Move	Equity
• 1	0	23/18* 9/5 0.652 0.049 0.001 - 0.348 0.091 0.001	+0.485
2	0	23/18* 20/16 0.487 0.063 0.002 - 0.513 0.298 0.021	-0.114 (-0.599)
3	0	23/18* 14/10 0.469 0.064 0.003 - 0.531 0.297 0.011	-0.144 (-0.629)

Commentary: Hit and cover! A deadly move! The alternative moves to hit and cover are designed to saturate the outfield with GNUBG blots to slow the opponent down with constant blot-hitting maneuvers. These alternatives are risky and yield much less equity compared to hitting the blot on 18 and covering the 5 point.

Move number 58: opponent to play 31



Pip counts: GNU Backgammon 131, opponent 77

• opponent moves bar/22 3/2*

Commentary: Forced move. Simultaneously hitting and slotting on the 2 would be a strong move in general and helps to create a needed deep anchor in the opponent's bear-off quadrant.

Cube decision

3-ply cubeless equity +0.120

0.567 0.130 0.003 - 0.433 0.145 0.002

Cubeful equities:

1. No double	+0.290
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2. Double, pass	+1.000	+0.710
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3. Double, take	-0.028	-0.319
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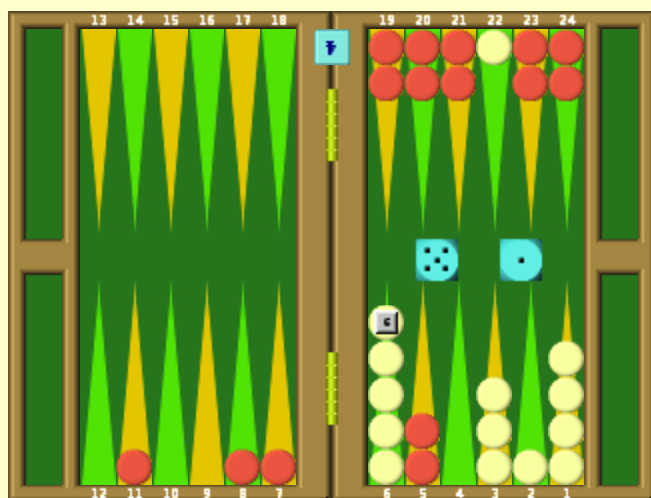
Proper cube action: No redouble, beaver (31.0%)

#	Ply	Move	Equity
1	3	bar/17 0.503 0.049 0.001 - 0.497 0.137 0.001	+0.102
2	3	bar/20 18/15 0.500 0.049 0.001 - 0.500 0.139 0.001	+0.087 (-0.015)
3	2	bar/20 14/11 0.465 0.048 0.001 - 0.535 0.158 0.001	-0.023 (-0.125)

Commentary: The 5 is forced. How the play the 3? A key priority in this position is to be able to hit the opponent's checker if the opponent runs the checker. If the

checker escapes, the game is essentially over for GNUBG. Statistically, if the opponent's back checker escapes, it is likely to land on the 7-13 points next move. The checker is unlikely to land on the 14-18 points. Having as many points occupied by GNUBG checkers in the 14-18 points increases GNUBG's chance of hitting the opponent's checker if the opponent's checker runs to the 7-13 points. GNUBG blots are safest from being hit by the opponent's back checker if those blots are on the 14-18 points. GNUBG gets an optimum mix of offense and safety by occupying as many different points as possible in the 14-18 area. Bar/17 results in 3 GNUBG blots in the 14-18 area, ready to pounce on the opponent's checker if it escapes. 14/11 puts a GNUBG blot at risk of being hit by the opponent's back checker, while 18/15 results in only two GNUBG checkers distributed in the 14-18 area, and there is an increased chance of GNUBG being hit, since a GNUBG blot on the 15 point will be hit if the opponent rolls a 6-6, 4-4, or 3-3. The GNUBG blot on 14 is 11 away from the opponent's checker on 3, so the opponent can only hit this blot with a 6-5 or 5-6 roll. GNUBG decided not to double prior to making this roll. Doubling would be risky considering that there was only one opponent checker back, and the opponent escaping this checker would mean an almost certain loss for GNUBG.

Move number 60: opponent to play 51

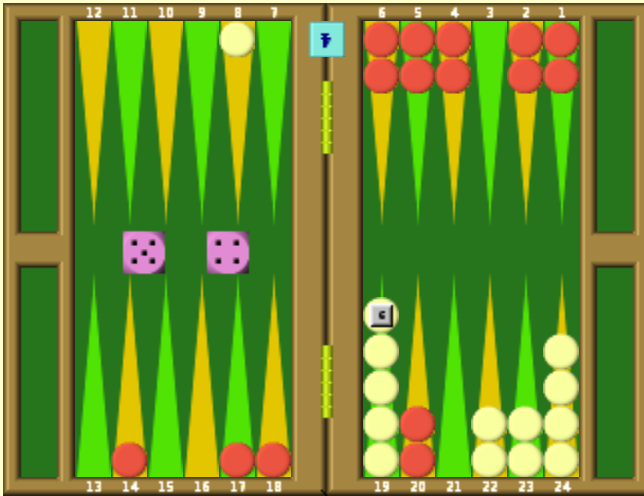


Pip counts: GNU Backgammon 125, opponent 73

• opponent moves 22/17 3/2

Commentary: 3/2 is obvious to close the bear-off board anchor. 6/1 would be the safe play. 22/17 starts running the blot on 22, but puts the blot a direct 6 shot away from GNUBG's checker on 11. There is no good time to run the checker on 22, so the opponent might as well run it now, although the probability is high that the blot will be hit. 6/1 might have been better.

Move number 61: GNU Backgammon to play 54



Pip counts: GNU Backgammon 125, opponent 67

• GNU Backgammon moves 17/8*

Cube decision

3-ply cubeless equity +0.062

0.561 0.031 0.001 - 0.439 0.091 0.001

Cubeful equities:

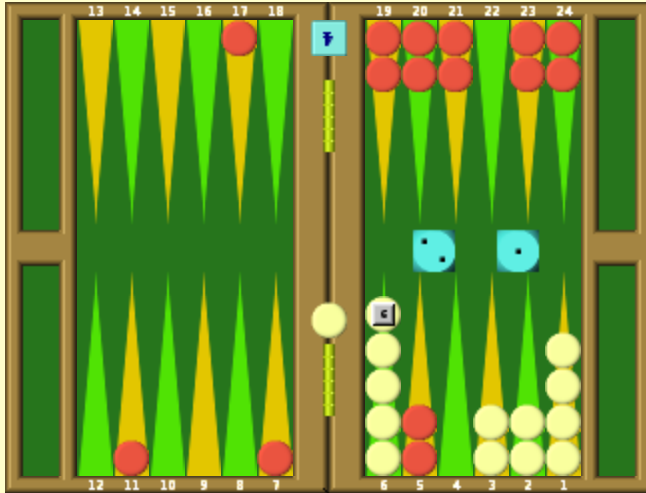
1. No double +0.261
2. Double, pass +1.000 +0.739
3. Double, take -0.134 -0.395

Proper cube action: **No redouble, beaver (34.8%)**

#	Ply	Move	Equity
• 1	0	17/8*	+0.499
		0.659 0.032 0.001 - 0.341 0.075 0.001	
2	0	14/5	-0.326 (-0.825)
		0.328 0.028 0.000 - 0.672 0.120 0.001	
3	0	20/15 18/14	-0.392 (-0.891)
		0.322 0.034 0.000 - 0.678 0.179 0.001	

Commentary: Hitting the opponent's blot is clearly the best move. The other alternatives are hardly worth considering. Prior to rolling, GNUBG decided not to double. With only one opponent checker back, and the remaining opponent

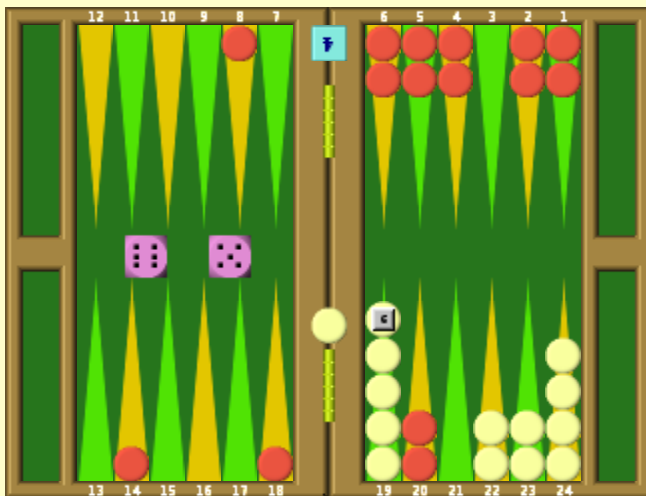
Move number 62: opponent to play 21



- **opponent cannot move**

Commentary: The opponent dances, and GNUBG's noose tightens further.

Move number 63: GNU Backgammon to play 65



Pip counts: GNU Backgammon 116, opponent 75

• GNU Backgammon moves 20/15 14/8

Cube decision

3-ply cubeless equity +0.425

0.717 0.036 0.001 - 0.283 0.046 0.001

Cubeful equities:

1. No double +0.736
2. Double, pass +1.000 +0.264
3. Double, take +0.658 -0.078

Proper cube action: **No redouble, take (22.9%)**

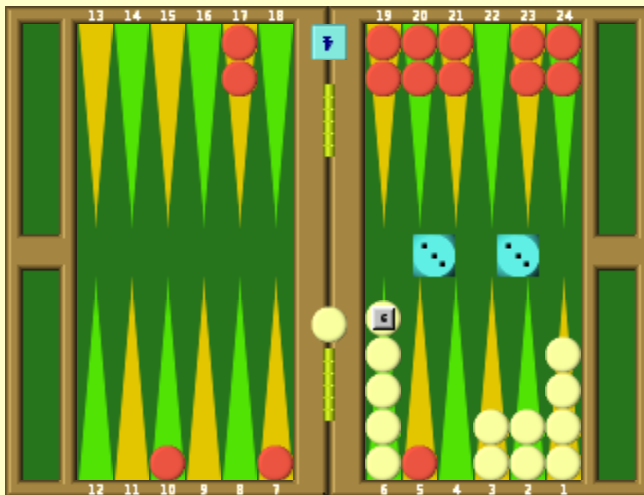
#	Ply	Move	Equity
• 1	3	20/15 14/8 0.724 0.041 0.001 - 0.276 0.032 0.000	+0.809
2	3	18/13 14/8 0.725 0.037 0.001 - 0.275 0.030 0.000	+0.803 (-0.006)
3	3	20/15 20/14 0.720 0.033 0.001 - 0.280 0.042 0.000	+0.782 (-0.027)

Commentary: Even with the opponent on the bar, GNUBG decides not to double. All but one opponent checker is in the opponent's bear-off quadrant, so if the opponent's brings the last checker into the bear-off quadrant, the opponent has a good chance of winning the game. There is still too much chance of the opponent's checker slipping through. Even if GNUBG delayed the opponent's checker from escaping until GNUBG had moved all of its checkers to GNUBG's bear-off quadrant, there is still a chance of the opponent rapidly moving the checker to the bear-off quadrant in time to have a decent chance of winning. 8/3, 14/8 is one move possibility, to slot a blot on the 3 point and possibly close out the bear-off board before the opponent brought in the checker. GNUBG did not consider this move due to the high potential cost if GNUBG's blot on 3 was hit and GNUBG had difficulty returning into a 4-point opponent bear-off board. During this time, the opponent could hit the GNUBG blot on 8, resulting in two GNUBG blots back and a potential disaster for GNUBG. Instead, GNUBG decided among three moves that all have a common theme of maintaining GNUBG blots in the 13-18 quadrant so that they would be able to hit the opponent's checker if the opponent returned the checker from the bar and ran the checker into the 7-12 quadrant. The three move choices are similar in value, as if no one choice is especially better than the others. GNUBG chose 14/8 to create an anchor on the 8 point, securing the blot on the 8 point and making it impossible for the opponent to bear in and hit on the next move. Meanwhile, the anchor on 8 would be a safe point from which GNUBG could form a point on the opponent's blot on the 3 point if the opponent came in. GNUBG could also hit the opponent blot on 3 with a spare builder, performing a hit and slot move that is powerful enough and high

yielding enough to justify the risk of having the GNUBG blot on 3 hit if the opponent returns. Merely putting a builder on the 3 point in this move, without the added advantage of destabilizing the opponent by hitting the opponent's blot, if the opponent was able to return a blot on the 3, does not provide enough offensive power to overcome the risk of the opponent's hitting GNUBG's builder blot on 3.

GNUBG chose to break the anchor on 20 with the 5 dice number, since this is as safe a time as any to start breaking up and running the 20 point anchor. Putting a checker on the 15 point has slightly more chances of hitting an opponent blot in the 7-12 quadrant compared to putting the checker on the 13 point. Hence 20/15 is slightly more superior to 18/13, although there is not much practical difference between the two moves. 20/15 20/14 puts more checkers in the 13-18 quadrant for potentially hitting an opponent blot in the 7-12 quadrant, however, this leaves many blots on the board and keeps the GNUBG blot on 14 exposed. If the opponent returned and hit that blot on the next move, the result could be disaster.

Move number 64: opponent to play 33

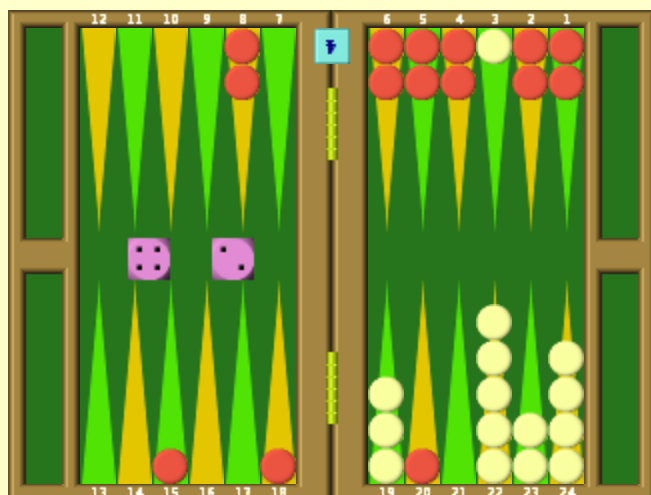


Pip counts: GNU Backgammon 105, opponent 75

- opponent moves bar/22 6/3(3)

Commentary: Forced move. There is now some risk of the opponent being forced to prematurely break up the anchor on the 6 point, if the opponent rolls a 4 or a 3 on the next move. Also, the 6 point has now been stripped so that there are now 3 checkers on the 6 point. In Backgammon, it is generally a vulnerable position for a player to have 3 checkers piled on a 6 point that is standing alone in the outer rim of a bear-off quadrant, with an opponent blot behind the 6 point, and the player lacking outfield checkers that are capable of playing some large number dice values. An awkward roll can force the opponent to move two checkers from that 6 point, exposing 1 blot, and possibly 2 blots.

Move number 65: GNU Backgammon to play 42



Pip counts: GNU Backgammon 105, opponent 63

• GNU Backgammon moves 20/14

Cube decision

3-ply cubeless equity +0.271

0.651 0.033 0.001 - 0.349 0.065 0.001

Cubeful equities:

1. No double +0.488
2. Double, pass +1.000 +0.512
3. Double, take +0.324 -0.164

Proper cube action: **No redouble, take (24.2%)**

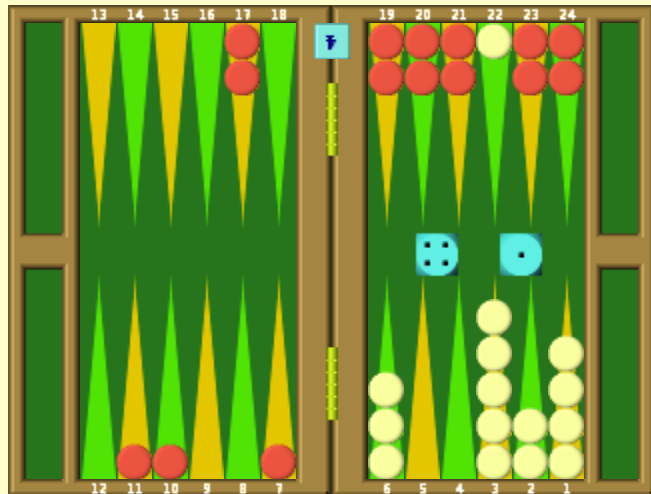
#	Ply	Move	Equity
• 1	3	20/14 0.599 0.033 0.001 - 0.401 0.054 0.000	+0.386
2	3	20/16 18/16 0.571 0.031 0.001 - 0.429 0.043 0.000	+0.332 (-0.054)
3	3	20/16 15/13 0.568 0.031 0.001 - 0.432 0.046 0.000	+0.320 (-0.066)

Commentary: Again, GNUBG decides not to double. There is too much chance of the opponent escaping the back checker. 4-2 is a rather awkward roll in this position. With this die roll, GNUBG cannot simultaneously hit and slot on the blot on 3, which would be GNUBG's best chance of winning the game. Instead, GNUBG's focus must be on positioning checkers in the 13-18 quadrant to maximize the possibility of hitting the opponent's checker if the opponent moves

the checker to the 7-12 quadrant. The differences between the three move choices are subtle. 20/16 18/16 is a safer play since it forms an anchor on 16, however, the advantages of the safe play are reduced since GNUBG would only be occupying two different spaces in the 13-18 quadrant, giving fewer chances of hitting the opponent's blot if the blot was in the 7-12 quadrant. With 20/16, 15/13, the opponent places 3 blots in the 13-18 quadrant, but GNUBG's blot on 13 can be hit with rolls of 4-6 or 6-4. With 20/14, the opponent also positions 3 checkers in the 13-18 quadrant, but the opponent can hit the blot on 14 with 6-5 or 5-6, and can hit the blot on 15 with 4-4 or a 6-6. GNUBG chooses 20/14 because there are two extra rolls of 4-4 that would allow the opponent to hit a GNUBG blot. This would give GNUBG a chance of bearing in the 19-24 quadrant such as to hit a stray opponent blot that the opponent might leave exposed if the opponent escaped the checker on 3 and started to bear off.

It is also possible that there are more chances of GNUBG hitting a blot in the 7-12 quadrant if GNUBG positions its checker slightly further away from the quadrant, on 14 instead of 13. This is due to a Backgammon axiom that, if a blot is positioned 1-6 pips away from an opponent, the blot is more likely to be hit if it is positioned closer to 6 pips away instead of being closer to 1 pip away. Also, if a blot is positioned 7-12 pips away from an opponent, the blot is more likely to be hit if it is positioned closer to 7 pips away instead of closer to 12 pips away. A simple review of die roll combinations and of the probability of getting a certain die number shows this.

Move number 66: opponent to play 41



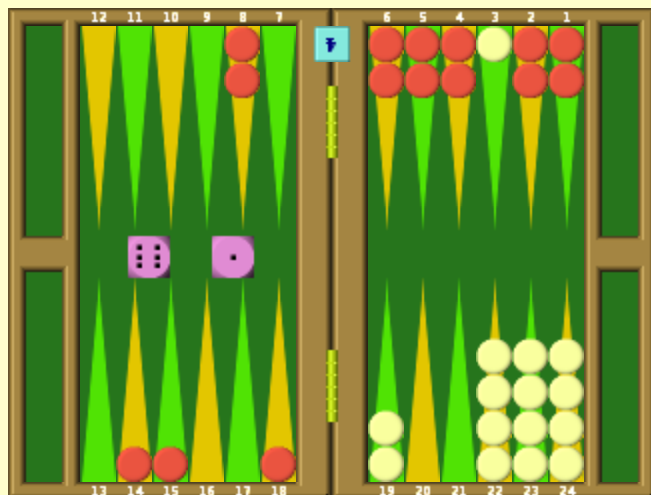
Pip counts: GNU Backgammon 99, opponent 63

• opponent moves 6/2 3/2

Commentary: Moving 22/18 with the 4 would bring the blot on 22 under the gun. This blot would very likely be hit, and the difficult attempt to return into a 5-point board would likely cost many tempos and result in certain loss for the opponent. Not to mention, GNUBG would close out the opponent by putting a point on 22. It

is too costly to attempt to race the blot on 22, so the safe, if rather pointless, move of 6/2, 3/2 was chosen. Moving the opponent's checkers more deeply into the opponent's bear-off quadrant may help the opponent avoid a gammon if the game goes badly for the opponent, and slightly increases the opponent's overall chance of winning the game, from decreasing the overall number of PIPs needed for the opponent to completely bear off the checkers.

Move number 67: GNU Backgammon to play 61



Pip counts: GNU Backgammon 99, opponent 58

• GNU Backgammon moves 18/17 14/8

Cube decision

3-ply cubeless equity +0.342

0.678 0.035 0.001 - 0.322 0.048 0.000

Cubeful equities:

1. No double +0.564
2. Double, pass +1.000 +0.436
3. Double, take +0.479 -0.086

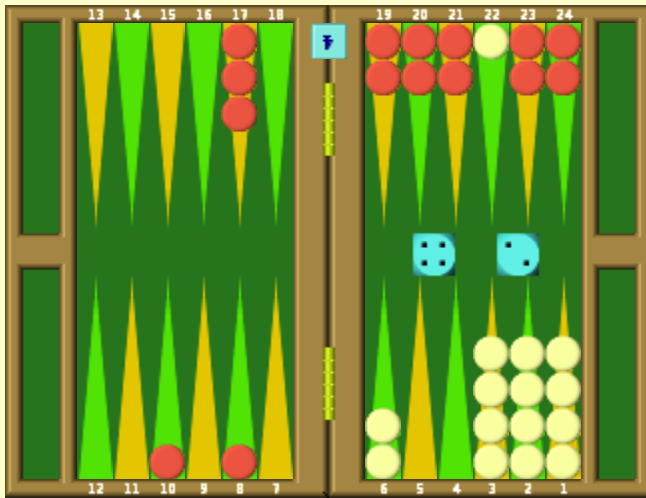
Proper cube action: **No redouble, take (16.5%)**

#	Ply	Move	Equity
• 1	3	18/17 14/8 0.587 0.034 0.001 - 0.413 0.031 0.000	+0.372
2	3	18/12 14/13 0.582 0.034 0.001 - 0.418 0.062 0.000	+0.342 (-0.030)
3	3	18/11 0.580 0.032 0.001 - 0.420 0.062 0.000	+0.324 (-0.048)

Commentary: There is still too much risk of the opponent escaping the back checker to double, and GNUBG would also lose ownership of the doubling cube if it did double. The 6 is an awkward number to play here. GNUBG would have preferred a 5, to allow a simultaneous hit and slot on the opponent's blot on the 3. Playing 6-1 is a subtle technical play here, perhaps too complicated for the carbon-based homo-sapien brain to precisely determine the best of the options. 15/8 is one choice in this position, but GNUBG rejects this choice and thinks that this choice is worse than the other three move options. GNUBG has several priorities in this position: to maximize the possibility of hitting the opponent's checker if the opponent escapes the checker to the 7-12 quadrant, to maximize the probability of forming an anchor on the 3 point and closing out the opponent, and also, if the opponent gets lucky and escapes the checker on 3 to the opponent's bear-off quadrant, GNUBG would want the opponent to hit a GNUBG blot so that there is some chance of GNUBG bearing the checker from the bar and hitting an opponent blot in the bear-off quadrant. The proper play of 6-1 would balance these three priorities.

18/17 14/8 makes the checker on 14 safe and puts that checker on the 8 anchor, where it might be able to hit and slot on 3 later on without breaking the 8 anchor. 18/17 14/8 results in blots on 15 and 17, which provide numerous shots to hit the opponent's blot if the opponent's blot escapes into the 7-12 quadrant. GNUBG favors 18/17 14/8 because it positions the checkers in the 13-18 quadrant slightly further back in that quadrant, making them slightly further away from the points in the 7-12 quadrant, which makes those blots more likely to hit the opponent's checker in that quadrant. (This applies the axiom that is explained in the commentary section of move #65. Positioning the checkers towards the 13, 14, and 12 points puts them too close to the opponent's blot that might be in theory become later positioned at the 7-12 quadrant.) 18/12, 14/13 bunches GNUBG's checkers on the 12 and 13 points, making them less likely to hit the opponent's blot if the opponent's blot, if that blot went into the 7-12 quadrant, would become positioned closely too those GNUBG checkers. There is also the chance that the opponent could, over the next two moves, hit two of GNUBG's blots if they were that close together. The opponent could hit one blot, and then if GNUBG did not enter on the next turn, hit the other blot. With two GNUBG blots on the bar, the opponent would have many tempos to get into the opponent's bear-off quadrant. 18/11 also results in a GNUBG blot distribution that is too close to the projected landing points of the opponent's blot in the 7-12 quadrant. 18/12 15/14 was not considered by GNUBG. This move would bunch the checkers too close to the 7-12 outfield spaces, and would be inferior to 18/12 14/13, which puts 3 GNUBG blots in position to hit the opponent's blot in the 7-11 spaces.

Move number 68: opponent to play 42

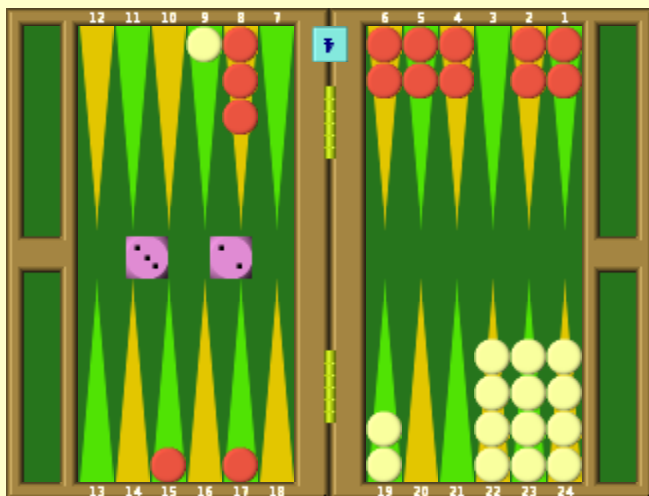


Pip counts: GNU Backgammon 92, opponent 58

- opponent moves 22/16

Commentary: Might as well run. Staying on 22 makes the opponent vulnerable to the opponent simultaneously hitting and slotting on 22, possibly closing out the opponent. With the opponent's blot on 16, GNUBG can hit with a 6 or an 8, 2-2, 3-3, or 4-4. Another choice is 6/2 6/4, which helps to strip the vulnerability that is the opponent's isolated 6 point anchor. However, this move creates an opponent blot on the 4 point, which reduces GNUBG's cost of being hit if GNUBG decides to perform a hit and slot move on the 22 point in the next move and sends the opponent's 22 blot to the bar. If the opponent hit GNUBG's blot on 22 while re-entering from the bar, GNUBG can then hit the opponent's blot on 4 while re-entering from the bar. Also, 6/2 6/4 maintains the opponent's blot on 22, leaving open the possibility of GNUBG performing the dangerous and powerful hit and slot move on the opponent's blot on 22.

Move number 69: GNU Backgammon to play 32



Pip counts: GNU Backgammon 92, opponent 52

- GNU Backgammon moves 8/6 8/5

Cube decision

3-ply cubeless equity +0.113

0.558 0.024 0.001 - 0.442 0.027 0.000

Cubeful equities:

1. No double +0.289

2. Double, pass +1.000 +0.711

3. Double, take -0.193 -0.482

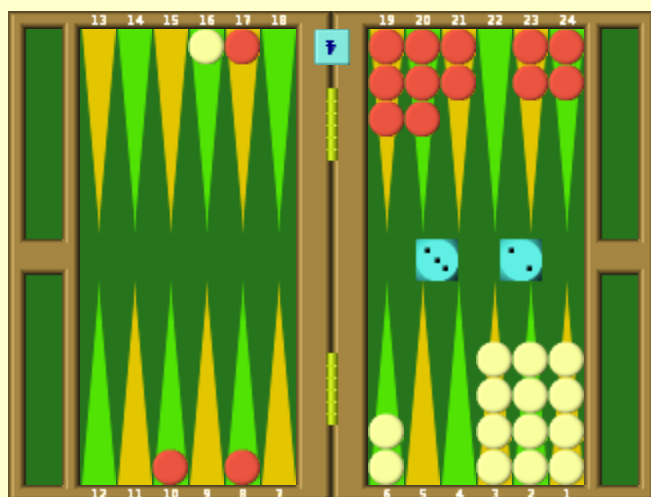
Proper cube action: **No redouble, beaver (40.4%)**

#	Ply	Move	Equity
• 1	3	8/6 8/5 0.237 0.010 0.000 - 0.763 0.037 0.000	-0.478
2	3	8/3 0.232 0.012 0.000 - 0.768 0.049 0.000	-0.508 (-0.030)
3	2	8/5 4/2 0.196 0.007 0.000 - 0.804 0.064 0.000	-0.598 (-0.120)

Commentary: The key priority here is to maximize the probability of hitting the opponent's blot on 9. If the blot escapes, GNUBG will probably lose. With a 3-2 roll, GNUBG cannot hit the blot on 9. GNUBG wants to keep the GNUBG blots in the 13-18 quadrant, so that they are available to hit the opponent's blot on 9. The

danger of the opponent hitting a blot on 15 or 17 is low since the opponent has two open spaces in the opponent's bear-off quadrant that are close to the outer edge of the bear-off quadrant, and the opponent may be forced to break the anchor on 19 soon, further opening up the bear-off quadrant. This makes it easier for GNUBG to return a hit blot and to escape that blot easily. The opponent also faces the danger of a blot-hitting mini-backgame if the opponent hits one of GNUBG's blots. This would be dangerous for the opponent with GNUBG having 5 blocks in GNUBG's bear-off quadrant. If GNUBG wants to keep the blots in the 13-18 quadrant as they are, this removes as a move choice 17/15 8/5, since the forming of a safe anchor on 15 is not that useful due to the relative lack of danger if the blots on 15 or 17 are hit, and not keeping the blots spread out over two positions greatly reduces the chance of GNUBG hitting the opponent's blot on 9. This chance must be maximized at all costs in this position! GNUBG will not want to move those blots further towards the opponent's blot on 9, since this reduces the probability of getting a dice roll that will hit the opponent's blot on 9 (see the axiom explained in the commentary section of move #65). This rules out 15/13, 17/14 as a move choice. The opponent will be more likely to run over or move beyond the GNUBG blots on 13 and 14 than if the GNUBG blots were on 15 and 17. 8/6 8/5 keeps the blots on 15 and 17 where they were, and puts builders on the 6 and 5 positions, ready to slot or form an anchor on 3, or simultaneously hit and slot on 3 if the opponent's blot is hit and the opponent returns on 3. 8/6 8/5 is also a useful running move that brings two checkers into the bear-off quadrant, reducing the chance of a gammon and in some scenarios being a key advantage to winning the game if GNUBG wins the game. 8/3 slots on 3, although this may be risky because if the opponent is hit, the opponent may return such as to return and hit simultaneously, which gives the opponent critical tempos to run the checker if the checker is sent back. 8/5 4/2 is probably not a good move, since it breaks the anchor on 4 prematurely. GNUBG wants his bear-off quadrant to be a formidable trap if the opponent is sent back, and breaking an anchor works against this. It is interesting that GNUBG thinks that the prematurely anchor-breaking move of 8/5 4/2 ranks as a better move than 17/15 8/5. This shows the great importance, in this position, that GNUBG gives to maximizing the probability of hitting the opponent's blot on 9.

Move number 70: opponent to play 32

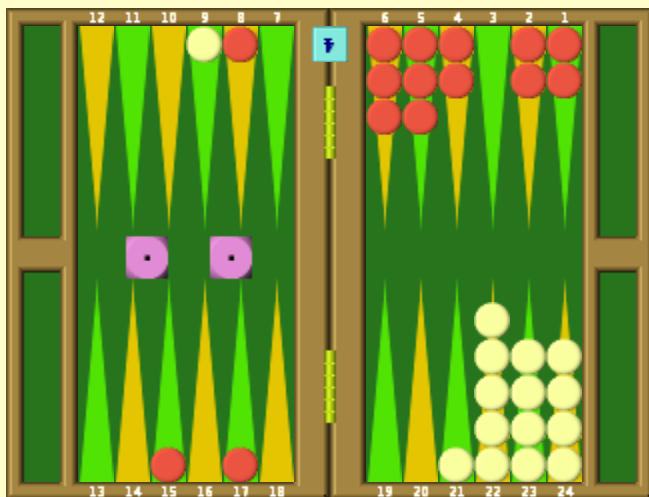


Pip counts: GNU Backgammon 87, opponent 52

• opponent moves 6/4 6/3

Commentary: Escaping the blot on 16 is a huge priority here, but not having that blot hit is also a huge priority, with all the firepower that GNUBG is concentrating on the 22 point. Moving 16/11 is a "pay now, pay later" move that puts the blot on 11 in range of two direct shot dice numbers (1 and 3), while keeping the blot on 16 puts the blot in range of only one direct shot number (6) and an indirect 8 shot. Running might be a better move, and some players would play 16/11, due to the great benefit of running. Running might be better now since the 22 point is still wide open, giving some slight chance of returning and escaping if the opponent's bot is hit. The opponent prefers (ideally) to move the blot on 16 to at least as far as the 9 point so that there would be no more than one direct shot to hit the opponent blot. Here, the opponent played 6/4 6/3, breaking up the anchor on the 6. This move helps to bunch all the checkers on the 1, 2, and 3 points, making the opponent less likely to be hit in a backgame. The anchor on the 6 is a liability that can result in a forced exposure of a blot. This blot can be hit if a GNUBG blot is hit and sent back to the opponent's bear-off quadrant. 6/4 6/3 leaves an opponent blot on the 4 point, however, it is highly likely that the opponent will be able to move that blot to safety within one or two moves.

Move number 71: GNU Backgammon to play 11



Pip counts: GNU Backgammon 87, opponent 47

• GNU Backgammon moves 8/4

Cube decision

3-ply cubeless equity +0.188

0.587 0.027 0.001 - 0.413 0.013 0.000

Cubeful equities:

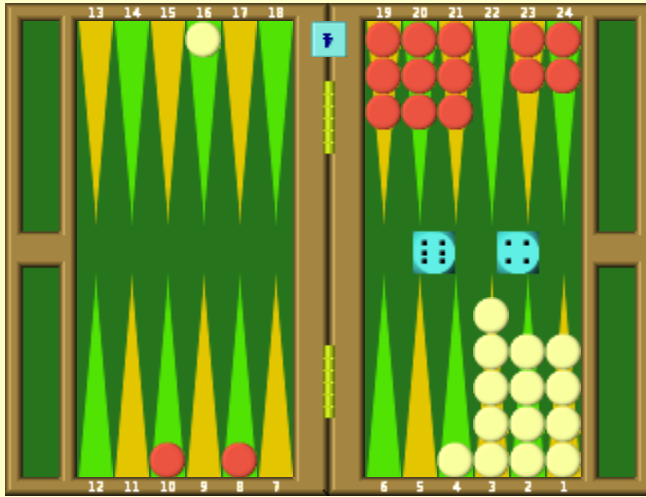
1. No double +0.327
2. Double, pass +1.000 +0.673
3. Double, take +0.029 -0.299

Proper cube action: **No redouble, take (30.8%)**

#	Ply	Move	Equity
1	3	8/4 0.267 0.023 0.001 - 0.733 0.014 0.000	-0.382
2	3	8/7 6/3 0.267 0.027 0.001 - 0.733 0.024 0.000	-0.413 (-0.031)
3	3	6/3 5/4 0.265 0.029 0.001 - 0.735 0.026 0.000	-0.415 (-0.033)

Commentary: Again, GNUBG does not want to move its blots on 15 and 17 any closer to the opponent's blot on 9, since this decreases the probability of hitting the blot on 9 on the next move, and increases the probability of the opponent leapfrogging beyond the GNUBG blots. GNUBG also does not want to form an anchor on 15 since this bunches the checkers on 15 and reduces the number of blots positioned to hit the opponent's blot on 9. GNUBG moved 8/4 to bring another checker into the bear-off quadrant and put another builder on the 4 point, increasing the fire power on the 3 point in case the opponent's blot on 9 is hit and the opponent comes in on the 3 point, or in general increasing the probability of GNUBG being able to form an anchor on the 3 using one die roll. GNUBG prefers not to slot on 3 in order to avoid the possibility of the opponent, if the opponent's blot was hit, returning to the 3 point such as to simultaneously return and hit the slotted GNUBG blot on 3. GNUBG would prefer that if the opponent was hit and returned, that GNUBG could hit the opponent's blot on 3 using one of GNUBG's builder blots on 6, 5, or 4, such as to simultaneously hit the opponent's blot and slot on the 3. It is interesting how this game resulted in a "stand-off" over several moves where two GNUBG blots were stuck on 15 and 17 and another opponent blot was stuck on the 9.

Move number 72: opponent to play 64

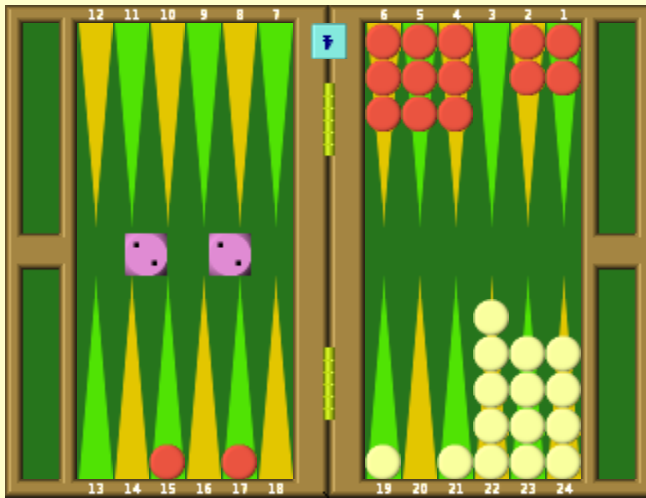


Pip counts: GNU Backgammon 83, opponent 47

- opponent moves 16/6

Commentary: A great running roll. The opponent played the 4 first, so as not to hit the GNUBG blot on 10, which would result in that blot coming in and potentially hitting the opponent's blots on 6 or 4. This roll efficiently moves the blot on 16 across two quadrants and puts the blot exactly one pip inside the bear-off quadrant. This move, although forced, illustrates an important axiom when racing checkers in Backgammon: the most efficient way to race a checker to the bear-off quadrant is to use a die roll such as to maximize the number of quadrants that the checker crosses over, and to bring a checker across a quadrant with the minimum number of pips needed to cross that quadrant. Here, a single roll moves the checker on 16 across two quadrants, with no waste of pips since the checker lands only one pip into the bear-off quadrant. The game has officially entered into a racing game, with the opponent having a 1 to 4 roll advantage with all checkers inside the opponent's bear-off quadrant. GNUBG will not be considering a re-double for the new future.

Move number 73: GNU Backgammon to play 22



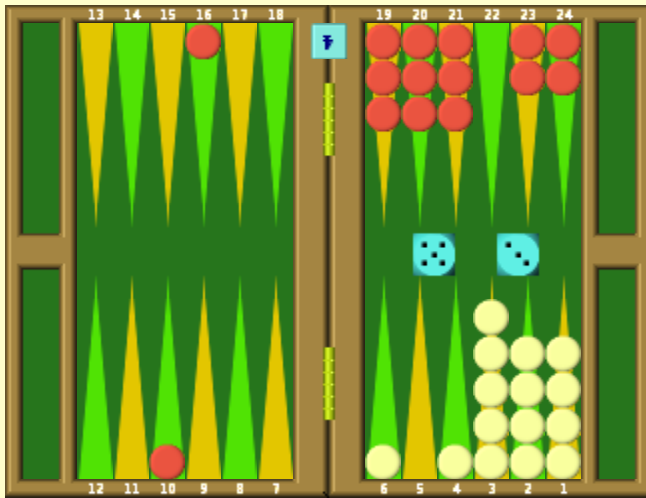
Pip counts: GNU Backgammon 83, opponent 37

- GNU Backgammon moves 17/9

#	Ply	Move	Equity
1	3	17/9 0.008 0.000 0.000 - 0.992 0.000 0.000	-0.980
2	3	17/11 15/13 0.008 0.000 0.000 - 0.992 0.000 0.000	-0.981 (-0.001)
3	3	17/11 6/4 0.008 0.000 0.000 - 0.992 0.000 0.000	-0.981 (-0.001)

Commentary: A pure racing roll. GNUBG finds almost no difference between the three move choices. 17/11 15/13 might be the best move, because with this move there are two dice numbers, 1 and 5, that allow GNUBG to efficiently move a checker across a quadrant with complete efficiency where the checker winds up exactly 1 pip inside the quadrant. With 17/9, only a 3 dice number allows a checker to move with 100% efficiency into the next quadrant. The 3 is duplicated since the checker on 9 and the checker on 15 are both 3 away from the next quadrant. 17/11 6/4 is not so good because it moves a checker inside the bear-off quadrant, instead of moving outfield checkers towards the bear-off quadrant. GNUBG would have probably be better off moving 5/3 instead of 6/4 if GNUBG wanted to move a checker within the bear-off quadrant. This move would put a checker on 3 so that the 3 was not stripped. However, 6/4 increases the number of doubles rolls that allow GNUBG to move 4 checkers off simultaneously with that one double roll. That slight advantage could be critical in the semi-miraculous event that GNUBG wins the game.

Move number 74: opponent to play 53

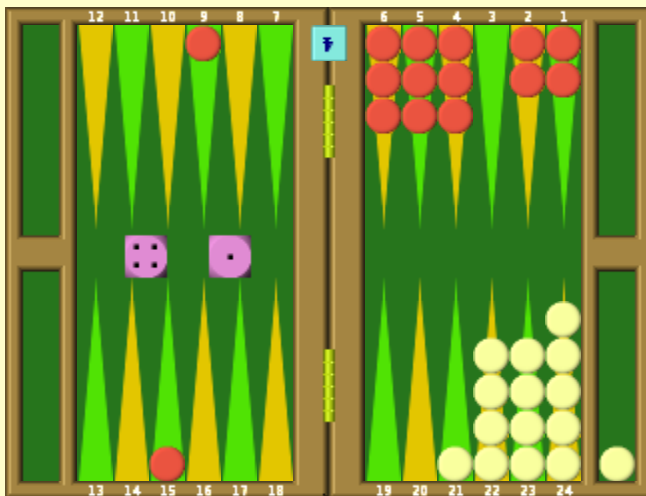


Pip counts: GNU Backgammon 75, opponent 37

- opponent moves 6/1 3/off

Commentary: 6/1 is forced. 3/off is the best use of the 3. In general, in the bear-off, the idea is to maximize the number of checkers that can be removed with each die roll. There are exceptions to this generalization, especially if a player is bearing off while there are still some opponent checkers located inside the bear-off quadrant, in a position to theoretically hit any blot that the player might leave exposed in the bear-off quadrant.

Move number 75: GNU Backgammon to play 41



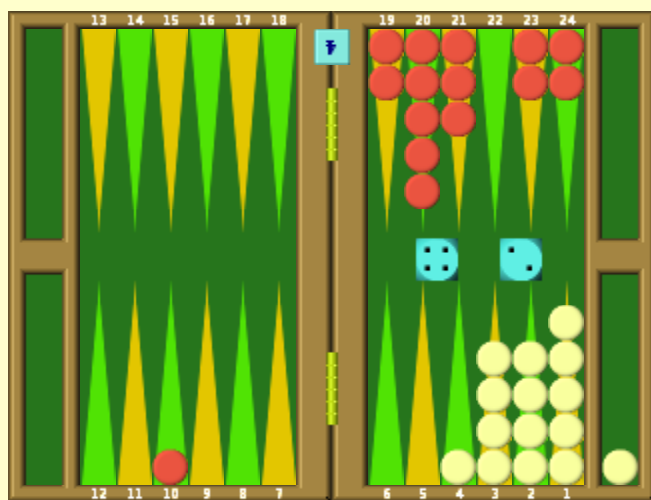
Pip counts: GNU Backgammon 75, opponent 29

• GNU Backgammon moves 9/5 6/5

#	Ply	Move	Equity
• 1	3	9/5 6/5 0.003 0.000 0.000 - 0.997 0.000 0.000	-0.993
2	3	15/11 6/5 0.003 0.000 0.000 - 0.997 0.000 0.000	-0.993 (-0.000)
3	3	9/5 4/3 0.003 0.000 0.000 - 0.997 0.000 0.000	-0.993 (-0.000)

Commentary: GNUBG sees no difference between the moves. Maybe it thinks that it is so unlikely for GNUBG to win the game, that it does not matter how GNUBG moves. The three move choices that GNUBG chooses all have moves within the bear-off quadrant. GNUBG may be trying to maximize the chance that miraculous doubles rolls will allow it to win the game. But it is probably better to first move all outfield checkers into the bear-off quadrant before making any moves within the bear-off quadrant. 9/5, 15/14 might be the best move here, even though the checker on 9 crosses into the bear-off quadrant with 2 pips into the quadrant instead of the most efficient 1 pip. Another general axiom when racing is to use a die roll to maximize the number of checker cross-overs into the bear-off quadrant, unless so many pips are wasted moving a checker into a bear-off quadrant that it is better instead to use a dice number to move an outfield checker closer towards the bear-off quadrant. A waste of 1 pip here is perhaps not a major problem. The sooner that checkers enter into the bear-off quadrant, the sooner will come the possibility that the opponent may roll a doubles roll that will allow the opponent to bring in all other outfield checkers into the bear-off quadrant, while also perhaps bearing off at least one checker, and all in the same move.

Move number 76: opponent to play 42

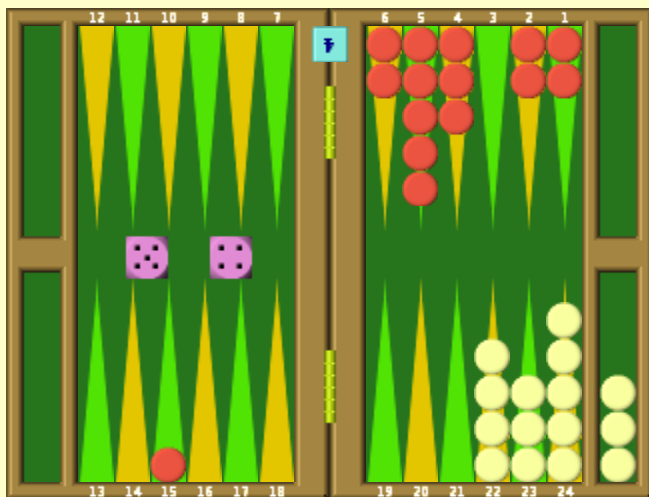


Pip counts: GNU Backgammon 70, opponent 29

- opponent moves 4/off 2/off

Commentary: This roll is used to remove the maximum number of checkers off the bear-off quadrant that is possible with this roll.

Move number 77: GNU Backgammon to play 54



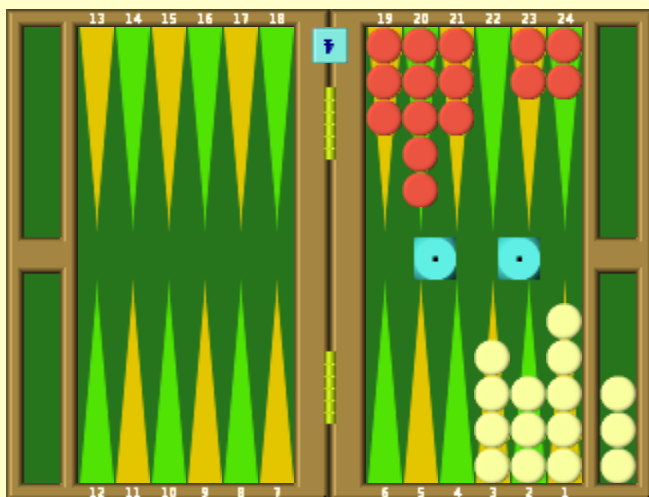
Pip counts: GNU Backgammon 70, opponent 23

- GNU Backgammon moves 15/6

#	Ply	Move	Equity
• 1	3	15/6 0.002 0.000 0.000 - 0.998 0.000 0.000	-0.996
2	3	15/10 6/2 0.001 0.000 0.000 - 0.999 0.000 0.000	-0.998 (-0.002)
3	3	15/10 5/1 0.001 0.000 0.000 - 0.999 0.000 0.000	-0.998 (-0.002)

Commentary: This move is used to move the checker on 15 with 100% efficiency into the bear-off quadrant, maximizing the number of quadrant cross-overs while bringing the checker exactly 1 pip into GNUBG's bear-off quadrant. The other move alternatives are inferior compared to bringing the final checker into the bear-off quadrant. GNUBG would be starting to remove checkers from the 6 and 5 points with the alternative moves. Removing these checkers increases the number of miracle doubles rolls that could allow GNUBG to win the game.

Move number 78: opponent to play 11

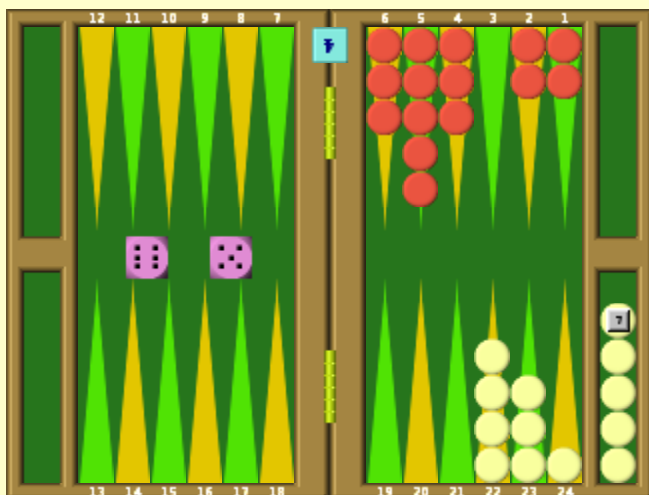


Pip counts: GNU Backgammon 61, opponent 23

• opponent moves 1/off(4)

Commentary: A nice double that removes 4 checkers with one roll.

Move number 79: GNU Backgammon to play 65



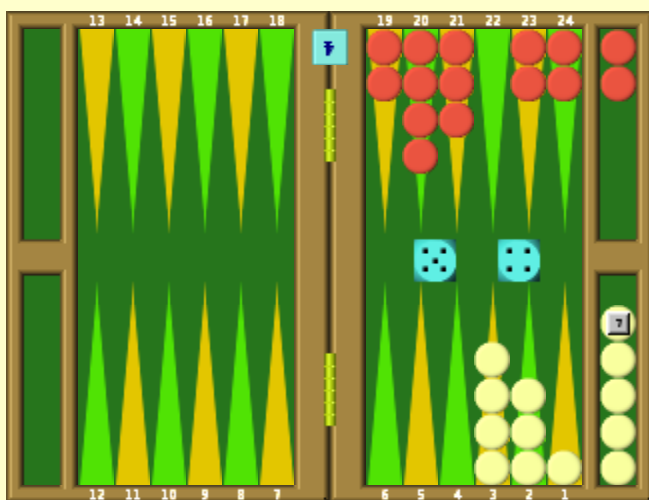
Pip counts: GNU Backgammon 61, opponent 19

• GNU Backgammon moves 6/off 5/off

#	Ply	Move	Equity
• 1	3	6/off 5/off 0.001 0.000 0.000 - 0.999 0.000 0.000	-0.999
2	3	6/1 6/off 0.000 0.000 0.000 - 1.000 0.000 0.000	-0.999 (-0.001)

Commentary: GNUBG removes the maximum number of checkers that the roll allows.

Move number 80: opponent to play 54

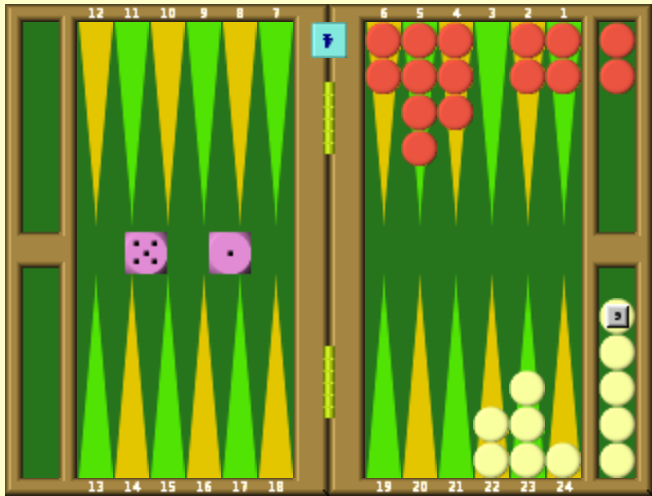


Pip counts: GNU Backgammon 50, opponent 19

• opponent moves 3/off(2)

Commentary: Forced!

Move number 81: GNU Backgammon to play 51



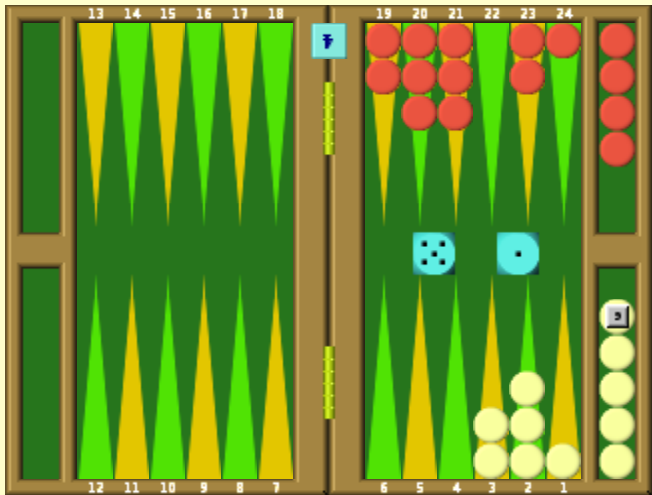
Pip counts: GNU Backgammon 50, opponent 13

• GNU Backgammon moves 5/off 1/off

#	Ply	Move	Equity
• 1	3	5/off 1/off 0.000 0.000 0.000 - 1.000 0.000 0.000	-1.000
2	3	5/4 5/off 0.000 0.000 0.000 - 1.000 0.000 0.000	-1.000 (-0.000)
3	3	6/off 0.000 0.000 0.000 - 1.000 0.000 0.000	-1.000 (-0.000)

Commentary: GNUBG removes as many checkers as possible. At this point, a loss is essentially guaranteed for GNUBG.

Move number 82: opponent to play 51

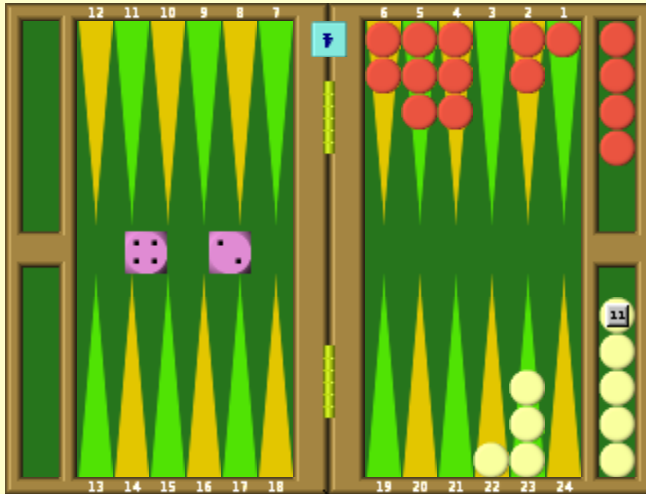


Pip counts: GNU Backgammon 44, opponent 13

- opponent moves 3/off 1/off

Commentary: Two checkers are removed. The 1 point is stripped, although this should not be a major problem, unless GNUBG gets multiple high doubles in a row and the opponent gets multiple 2-1 rolls in a row. In some parallel universes, such a wonderful miracle may happen with this game.

Move number 83: GNU Backgammon to play 42



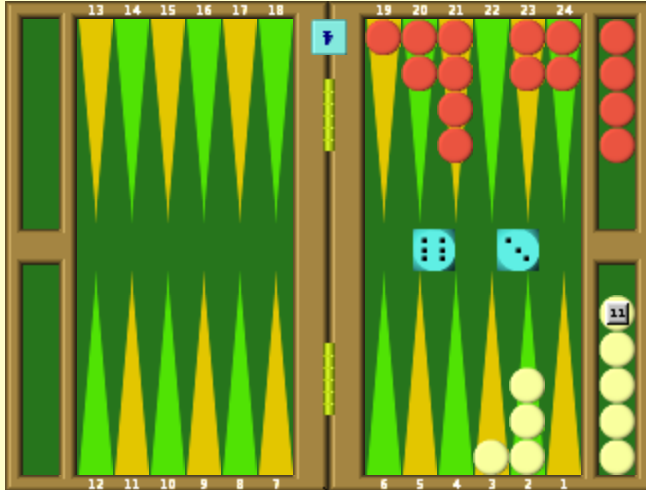
Pip counts: GNU Backgammon 44, opponent 9

- GNU Backgammon moves 6/4 5/1

#	Ply	Move	Equity
• 1	3	6/4 5/1 0.000 0.000 0.000 - 1.000 0.000 0.000	-1.000
2	3	5/3 5/1 0.000 0.000 0.000 - 1.000 0.000 0.000	-1.000 (+0.000)
3	3	6/2 4/2 0.000 0.000 0.000 - 1.000 0.000 0.000	-1.000 (+0.000)

Commentary: GNUBG is doomed at this point. No move is better than the other. The miracle 6-6 roll did not occur, and even if it did occur, more miracle 6-6 and 5-5 rolls would be needed to win. Don't bet your last hamburger on GNUBG winning this game.

Move number 84: opponent to play 63



Pip counts: GNU Backgammon 38, opponent 9

• opponent moves 3/off 2/off

Commentary: To quote Ms. Pacman: "Game Over."

opponent wins 4 points

Suggested Books for Reading (older books may have outdated theories):

1. Backgammon, 1976 and 2004 editions, by Paul Magriel.
 2. New Ideas in Backgammon, 1996 edition, by Kit Woolsey and Hal Heinrich.
 3. 501 Essential Backgammon Problems, 2004 edition, by Bill Robertie.
 4. Backgammon for Profit 1978 edition, by Joe Dwek.
 5. Advanced Backgammon, volumes 1 and 2, 2000 editions, by Bill Robertie.
 6. Championship Backgammon: Learning Through Master Play," 1980 edition, by Barclay Cooke.
 7. Paradoxes and Probabilities: 168 Backgammon Problems, 1978 edition, by Barclay Cooke.
 8. Improve Your Backgammon, 2003 edition, by Paul Lamford.
 9. Tesauro, G. (1995). Temporal difference learning and td-gammon. Communications of the ACM , 38(3):58–68.
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How this PDF file was Created

A source file called `gnubg_vs_mamoun_html_source_files.zip` contains the html source code used to derive the PDF file, and the `html-images` directory used as the source of the graphics for the diagrams in the file.

After playing this game with GNU Backgammon, the game was saved through GNU Backgammon's HTML output of the saved game. The diagrams for the game consist of separate small graphics files that GNU Backgammon arranges into diagrams by fitting the individual graphic pieces into an HTML table.

The colors of the board diagrams are created by going to the GNU Backgammon settings tab where there is an option called "Board Appearance" that allows a player to choose the board color scheme. This color scheme can then be saved into a folder called `html-images` that contains the numerous small graphics files that make up the diagrams. To save the color scheme, in the Settings tab, choose "Export." In the "Export" window, choose the tab called "Style." Choose the sizes of the PNG images and HTML images (3 is a good size for a PDF file of a match), then click on the "Generate HTML images" button. This will generate a directory of all of the board graphics and colors chosen, and the directory will be in the location specified after pressing the "General HTML images" button. The default name of this directory is "`html-images`." This directory has to be a sub-directory of the directory that will contain the actual html file of the saved game or match. The HTML file of the game will display graphics files from the `html-images` directory.

For this PDF file, a size of 3 was chosen in the options for the size of the board diagrams. The color scheme for the board diagram is based on the green/red /yellow color scheme of the board diagrams from Gary Tesauro's 1995 paper on machine learning in Backgammon, which explained the programming of the TD-Gammon neural net Backgammon computer program for the old OS/2 operating system. The original GNU Backgammon HTML game summary output file required some modification to convert it to a formatted PDF file. The text width was set at 625 pixels. Various color changes were made in the HTML file, by adding html color codes to the HTML file. In the section towards the beginning of the html file, that begins with the word `.movetable`, there are various options for choosing HTML colors for various graphical components of the cube decision and move description graphics. The codes for the HTML colors were obtained by using websites on the internet that allow one to pick colors and see the corresponding HTML code for the colors. For example, the background color of the entire PDF file is a light yellow color with the HTML code of `#FFFFCC`.

To edit the HTML file, the file was duplicated, and the file extension of the copy was changed from `.html` to `.txt`. This `.txt` file was then loaded up into OpenOffice Writer (the open source word processor program), edits were made, and the file was saved with a new file name. This file was then duplicated, and the duplicate extension was changed from `.txt` to `.html`, and the HTML file was loaded up into

Firefox or Safari to see what the changes look like. A commentary section was added below each move choice to provide commentary about the move.

The HTML file was converted to a PDF file using the Firefox or Safari web browsers for the OS/X MAC operating system. The HTML file was loaded offline into the browser (after making sure that a the directory containing the HTML file contained a sub-directory consisting of the html-images directory to provide the graphics files for the HTML file). Then, the print window was selected. The three boxes, "Ignore Scaling and Shrink to Fit Page Width," "Print Background Colors," and "Print Background Images" were checked to activate those three options. Then, in the lower left corner of the print box there is a PDF option that was clicked with the mouse. In the PDF option the option to save as a PDF file was chosen.

The resulting PDF file was loaded up in the Adobe Acrobat PDF reader. Since the GNU Backgammon diagrams are not single graphics photos but consist of tables with graphics embedded in the tables, the graphics would often be cut off in the PDF file due to page breaks. In general, tables in HTML files tend to be cut off due to page breaks when printing or after converting the HTML file into PDF. This problem was solved by manually inserting carriage returns throughout the HTML file, to push down on the page any cut off graphics, until the entire graphic appeared on the next page. The BR command is the HTML carriage return command. Basically, after loading the PDF file, the file was scrolled through until the first cut-off graphic was found. Then, the code that begins this particular graphic was located in the HTML file, and enough BR carriage returns were put before the start of this graphic to push the graphic far down enough on the page until the graphic was no longer cut off, but appeared on the next page intact. The edited HTML file was converted to a new PDF file, and this PDF file was then loaded into Acrobat Reader to make sure that the graphic was no longer cut off. Then, the reader scrolled down further through the PDF file until the next cut-off graphic was found. This code for this next cut-off graphic was located in the HTML file, and more carriage returns were added to push that graphic down further in the PDF file until it was no longer cut off. This process was repeated until there were no more cut-off graphics in the PDF file.

Output generated Mon Oct 06 09:09:51 2014 by GNU Backgammon
1.03.000-mingw 20140804 (HTML Export version 1.235)